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THE BRITISH ANTARCTIC EXPEDITION.

Reception of Ernest H. Shackleton, C.V.O., and his Companions at the Albert Hall.

Mr. Shackleton arrived in England on June 12, and on Monday, June 28, the Society held a meeting in the Albert Hall for the reception of himself and his companions. The hall was filled with Fellows and their friends up to the gallery. His Royal Highness the Prince of Wales, the Vice-Patron of the Society, sat alongside the President, Major Darwin, on the platform; while Her Royal Highness the Princess of Wales occupied a seat in front of the arena. On the platform were the Members of Council and many distinguished explorers, in addition to the members of Mr. Shackleton's expedition who had arrived in England.

Before the meeting the Geographical Club entertained Mr. Shackleton and his companions to dinner at the Royal Palace Hotel. His Royal Highness the Prince of Wales was present, besides the Italian Ambassador and other distinguished guests. After the toast of the King, the President proposed the toast of Mr. Shackleton and his companions, and Dr. Georg Wegener, as delegate of the Council of the Berlin Geographical Society, presented the congratulations of that Society to Mr. Shackleton on his achievement. Mr. Shackleton briefly replied.

At the Albert Hall Mr. Shackleton contented himself with giving a condensed account of the course of his expedition and some of its results, illustrated by many photographic slides and some interesting cinematograph films. In a future number a full account will be given of the geographical and other scientific results of the expedition, along with a detailed map. As will be seen, the Prince of Wales presented a special Gold Medal, awarded by the Society, to Mr. Shackleton, and silver replicas to his companions.

The PRESIDENT in introducing Mr. Shackleton said:—

We have assembled here to-night to hear an account of a journey made to the highest latitude ever attained by any human being; to rejoice, in fact, at the safe home coming of Mr. Shackleton and his companions. We are not yet in a position to express final opinions on the scientific results of this expedition; but, as far as can be judged, they reflect the highest credit on all concerned. As to the latitude reached, it has been the policy of our Society neither to promote nor to reward either mere record breaking or any mere race to either pole because there is no reason to suppose that any especial scientific interest attaches to that particular spot on the Earth's surface. But it would be mere cant not to acknowledge that we are all proud of the fact that it is one of our own countrymen who at the present time has made the nearest approach to a pole of the Earth. The feat performed by Mr. Shackleton will, however, for ever remain notable, even if examined in the coldest light of geographical science; for he has succeeded in penetrating for over 400 miles into hitherto absolutely unknown land. For those of us who have not travelled in Arctic and Antarctic Regions, it will require all our powers of imagination, when listening to Mr. Shackleton, to fully realize all the difficulties encountered, and the magnitude of the feat accomplished. Possibly I may be able to assist you in the realization as regards the distances covered by the explorers. Imagine England, Scotland, and the North sea to beyond the Shetland islands, a dreary expanse of ice and snow, with a few isolated rocky masses showing through the frozen covering. Imagine yourselves leaving London on foot for the North, a small party of men and ponies. Onwards you march, and at Edinburgh—equivalent to Scott's furthest—you enter a region never before traversed by man. Onwards you trudge, losing your last surviving pony at Inverness, on past the northernmost point of Scotland, on across the frozen North sea, finding high mountain ranges at the Shetland islands. Onwards you drag your sledges, until 240 miles north of John of Groat's further progress becomes absolutely impossible. And then comes the even more arduous return march, without ponies, for 752 miles as the crow flies, and far more in actual distance travelled. Imagine such a journey as this, and it will help you to realize the marvellous feat which I now ask Mr. Shackleton to describe to us.

Mr. Shackleton then gave an account of the work of the expedition, of which the following is a summary:—

After a few words of introduction, Mr. Shackleton proceeded to show lantern-slides illustrating the departure of the expedition from New Zealand, and the voyage down to the Antarctic circle. The little *Nimrod* was being towed by a steamer at this time, in order that her own coal might be saved, and very severe gales were encountered. A photograph taken from the *Nimrod* showed an enormous wave cutting

off all view of the steamer except the masts and the top of the funnel. The lecturer proceeded to explain how it was that he had to abandon his original intention of wintering on King Edward VII. Land. He found that Balloon inlet, which had been discovered by the National Antarctic expedition six or seven years previously, had disappeared altogether, the Great Ice Barrier having broken away at that point. His progress towards King Edward VII. Land was blocked by heavy consolidated pack-ice, extending from the Barrier fully 100 miles north, and all efforts to find open water to the east were unavailing. Under these circumstances the plans of the expedition had to be changed, and the winter quarters were placed on Cape Royds, at a point in McMurdo sound about 20 miles north of the winter quarters of the *Discovery* expedition. He explained the difficulties that were encountered in landing the stores, including the ponies and the motor-car, in the face of moving ice and a blizzard, with a temperature down to about 16° below zero. As a result of this blizzard the stores that had been landed on the shore were buried deep in solid ice, caused by the freezing of the sea-spray, and picks and crowbars were required to dig out the cases. The hut was erected under the shelter of some small volcanic hills, in order that it might have some protection from the fierce gales that rushed down from the frozen south. Close behind rose the foothills of Erebus, with the great volcano itself towering into the sky about 20 miles away, a cloud of steam and smoke generally trailing from its summit, and serving as a most valuable indicator of the direction of the upper currents of the air for the meteorologists of the expedition. After showing photographs illustrating life at the winter quarters, the lecturer told the story of the ascent of Erebus, the first of the achievements of the expedition. On March 5, 1908, a party of six men, comprising Prof. David, Douglas Mawson, Adams, Brocklehurst, Marshall and Mackay, began the ascent of the mountain, and in the face of difficult ice and very low temperatures made steady progress upwards. On the second day out a blizzard swept down upon them, and for thirty hours they had to lie in their sleeping-bags. When the wind abated, they continued their climb, and though Brocklehurst suffered from frostbite, they finally reached the summit, and looked down into the live crater. Some very interesting photographs illustrated the adventures of this party.

Early in the spring the sledging journeys commenced, and as a first step towards the attack on the South Pole a depôt with provisions was laid at a point about 120 miles south of the winter quarters. Only four ponies were left at this time, four having died during the winter as a result of eating volcanic sand. While the depôt party was away, under the leadership of Mr. Shackleton, the Magnetic Pole party, consisting of Prof. David, Mawson and Mackay, started north. This

party had first to relay its provisions and equipment for about 200 miles over the sea-ice, taking one sledge on a couple of miles and then returning for the other. Then the men went inland, and after many discouragements, succeeded in ascending the inland plateau and reaching the South Magnetic Pole, January 16, 1909, where they hoisted the Union Jack, and took possession of the land on behalf of His Majesty the King. They went back to the coast with all possible speed, being short of provisions; but when they reached there, they found that the sea-ice over which they had journeyed on the outward march had broken up, and that they were faced by open water. They were camped on the coast, feasting on seal-meat and blubber, when the *Nimrod* appeared opportunely, conducting a search ordered by Mr. Shackleton, and picked them up.

In the meantime Mr. Shackleton himself, accompanied by Adams, Marshall, and Wild, had gone south, taking with him the four ponies, four sledges, light equipment, and provisions for ninety-one days. A supporting party travelled with him for the first few days, and then returned to the winter quarters. The four men pushed south with all possible speed, and, in spite of dangerous crevasses and a soft surface, made rapid progress. They picked up the depôt, and on November 26 passed the previous "furthest south," twenty-four days after leaving Hut point. By this time they were sighting new land, for they were taking a line further east than the previous expedition, and therefore commanded a wider view of the western mountains. At intervals they killed a pony and established a depôt, leaving provisions and some of the meat to carry them over the return journey. They continued to discover ranges of new mountains as they moved south, and as the direction of the mountains was about south-east, it became evident that they would have to find a way through, if they were to march due south towards the Pole. On December 3 they climbed a mountain 4000 feet high, and from its summit saw what they believed to be a royal road to the Pole—an enormous glacier stretching southwards. There was only one pony left at this time, and, taking this animal with them, they started the ascent of the glacier, which proved to be seamed with crevasses. Progress became very slow, for disaster threatened at every step. On December 7 the remaining pony was lost down a crevass, very nearly taking Wild and a sledge with it. Mr. Shackleton gave a graphic account of the climb up the great glacier, and showed photographs of the new mountains that were discovered east and west of their course. Finally, the party gained the inland plateau, at an altitude of over 10,000 feet, and started across the great white snow plain towards the Pole. They were short of food, and had cut down their rations to an absolute minimum; the temperature at the high altitude was extremely low, and all their spare clothing had been deposited lower down the glacier in order to save weight. On

January 6 they reached lat. 88° 8′ S., after having taken the risk of leaving a depôt of stores on the plateau, out of sight of all land. Then a blizzard swept down upon them, and for two days they were unable to leave their tent, while, owing to their weakened condition and the intense cold, they suffered from frostbite even in their sleeping-bags. When the blizzard moderated on January 9 they felt that they had reached their limit, for their strength was greatly reduced and the food was almost done. They therefore left the camp standing, and pushing on for five hours, planted Queen Alexandra's flag in lat. 88° 23′ S., took possession of the plateau for the King, and turned their faces north again. Mr. Shackleton described the difficulties of the journey back to the coast, when the men were desperately short of food, and nearly worn out, and attacks of dysentery added to their troubles. On the morning of January 26, when still 30 miles from their depôt at the foot of the glacier, they ran out of food, and marched till two o'clock on the following afternoon, almost without a stop and with nothing but a little tea to maintain their strength. They got to within half a mile of the depôt in an exhausted condition, and then Marshall went on and brought back food. One day on the Barrier they were unable to march at all, being prostrated with dysentery, and they reached each depôt with their food finished. On February 23, however, they reached a depôt prepared for them by a party from the ship, and on March 1 Mr. Shackleton and Wild reached the *Nimrod*. Mr. Shackleton at once led a relief party back to get Adams and Marshall, the latter having been unable to continue the march owing to dysentery, and on March 4 all the men were safe on board. The lecturer sketched the work of the western party, which studied the geology of the mountains to the west of McMurdo sound, and narrowly escaped death on a drifting ice-floe. He mentioned the discovery of 45 miles of new coast-line to the west of Cape North, and in conclusion showed some very interesting pictures illustrative of the seal and penguin life in the Antarctic.

After the lecture the PRESIDENT said:—

Many noble qualities are necessary to make a successful leader of explorations into unknown lands; and the first of these qualities is courage. Mr. Shackleton has dwelt but lightly on the perils he has encountered, but sufficiently to make us see that he possesses this quality in a remarkable degree. But mere courage is almost useless without the knowledge and the imagination necessary to enable the explorer both to realize risks in advance and to make full use of the opportunities afforded for observing facts. Long study in advance is absolutely essential, whilst actual previous experience is of enormous assistance. Not the least of Mr. Shackleton's merits as a leader was, I believe, the care he took to make the utmost use of the experience he had previously gained when serving on the National Antarctic Expedition under Captain Scott. The work done on the earlier voyage has borne much

fruit on the later one. It is not, however, my intention to detain you any further with any remarks of my own; because it is obviously only those who have travelled in Arctic or Antarctic lands who are really competent to express opinions on such matters. I will, therefore, at once call on Captain Scott, whom I may call the pioneer of the route to the South Pole, and whose name will for ever be associated with this region, to propose a vote of thanks to Mr. Shackleton, the hero of this evening.

Captain R. F. Scott: I regarded it as a great privilege to have been asked to propose this vote of thanks to-night, but it seems almost superfluous to do so now; the applause which has greeted Mr. Shackleton's lecture must convince him how much we appreciate his work. I think our admiration for his deeds may be equalled now with our gratitude for the way in which he has told his story to-night. I do not think it is possible to have followed the lecture with greater or more vivid interest than I have done. The pictures we have been shown recall old memories and associations, and Mr. Shackleton's tale carried me back to those times when we were together in the south, and when he was always one of the first at a job of work. One of the reflections that comes to me to-night is, that this magnificent work of his crowns a great attack on the South Pole, and it is extraordinary to think with what speed that attack has been pushed forward. We all know what long and persistent efforts have been made to get to the North Pole, but only a decade has passed since there was that strong revival in South Polar exploration which has achieved so much. I think that the name of the man who started this last and most successful campaign of South Polar exploration should be remembered to-night, and I am glad to say Mr. Shackleton has told me that the mountain we named in the honour of Sir Clements Markham still remains the highest and most dignified peak in that chain of wonderful mountains which flanks the road to the South Pole. The father of South Polar exploration has expressed his appreciation of Mr. Shackleton's effort, and I will not detain you longer except to pay my small tribute also to the great work which has been accomplished by an old companion. We honour him for the manner in which he organized and prepared his expedition, for the very substantial addition he has made to human knowledge, but most of all because he has shown us a glorious example of British pluck and endurance.

Admiral Sir Lewis Beaumont: It is with great pleasure that I second the vote of thanks which it is proposed to give to Mr. Shackleton to-night. Ever since those stirring telegrams came last March, announcing the remarkable result of his expedition, we have been looking forward, with great interest, to hearing the story of that wonderful journey by which Mr. Shackleton, with so much courage and intrepidity, has reached the farthest latitude towards the South

Special Antarctic Medal presented by the Royal Geographical Society to Ernest H. Shackleton, C.V.O.. in gold, and to the members of the British Antarctic Expedition in silver, June, 1909.

Pole. In common with every one here—but perhaps because of having formed one of a former Arctic expedition, I am able to realize more vividly the dangers which have been faced and the difficulties which have been overcome—I am very glad of the opportunity to show, as we all do who are here to-night, my great admiration at the courage, the skill, and the manly endurance which has been shown by Mr. Shackleton and his companions in pushing forward and planting the British flag at such a distant point of those unknown regions. I also admire, and as his countryman am proud of, what I am sure you will agree is in keeping with the best traditions of all great explorers, and that is, the modesty with which he has spoken of himself, and the generosity with which he has always spoken of his companions. Mr. Shackleton and his little band have shown the qualities of true explorers. First in their daring spirit of enterprise and adventure, allied as it has been with the modern requirement of careful attention to scientific research, the results of which, after all, are the lasting fruit of such expeditions. I most cordially second the vote of thanks to Mr. Shackleton.

After the vote of thanks was proposed and seconded, the President said: A vote of thanks to Mr. Shackleton has been proposed and seconded. This vote I do not, however, intend to put to the meeting, for two reasons. In the first place it is unnecessary. In the second place the ceremony which is about to take place, the presentation of medals to the explorers by His Royal Highness the Prince of Wales, Vice-Patron of the Society, will afford to us a suitable opportunity of expressing our feelings.

H.R.H. The Prince of Wales: It now only remains for me, as Vice-Patron of the Royal Geographical Society, to present to Mr. Shackleton the special Gold Medal which has been struck by the Society in recognition of his great and unique achievement of having reached a point within 100 miles of the South Pole. He not only traversed about six degrees of absolutely unknown ground, but the results obtained by him and his able staff will be most valuable to scientific knowledge. I have listened with the deepest interest to the graphic descriptions of his wonderful journey, illustrated, as they have been, by the beautiful photographs which he has shown us. At the same time, we can realize, perhaps, only to a certain extent, all the terrible hardships which he and his brave comrades successfully overcame. It is now just two years ago that I took leave of Mr. Shackleton on board the *Nimrod* in Cowes roads. I am indeed happy that at this moment I can congratulate him and his comrades most heartily on their safe return home; and as a brother-sailor, I am proud to hand him this medal.

Mr. Shackleton: I thank you for giving me this medal. I feel that this is a token, coming from the greatest geographical society in the world, of appreciation of the work that my comrades and I myself have

been able to do down South, and I feel we always will remember this night, and your presence here, your Royal Highnesses, for it has been a happy occasion to us to come back and relate some of the stories of the South. We feel greatly honoured, sir, and I can't make much of a speech about it.

H.R.H. THE PRINCE OF WALES: Mr. Shackleton has spoken in the highest praise of his comrades. We know how loyally they served him, and thus greatly conduced to the success of this expedition. In recognition of their services, the Royal Geographical Society has conferred upon them replicas in silver of the special Gold Medal.

The Prince of Wales then presented silver replicas to the following members of the expedition:—

Lieut. J. B. Adams, R.N.R.; Mr. B. Armytage; Sir Philip Brocklehurst; Mr. B. Day; Mr. E. Joyce; Mr. E. L. A. Mackintosh; Dr. Eric Marshall; Mr. G. E. Marston; Mr. James Murray; Mr. R. E. Priestley; Mr. W. Roberts; Mr. F. Wild.

The following, not present, were also awarded the silver medal:—

Prof. T. W. Edgeworth David; Captain F. P. Evans, R.N.R.; Dr. A. Forbes Mackay; Mr. Douglas Mawson.

At the conclusion of the meeting the PRESIDENT said:—

I am sure you will wish me to express in your name, before this meeting adjourns, our thanks to His Royal Highness the Prince of Wales for so kindly attending here to present these medals. This meeting is now adjourned.

SURVEY AND EXPLORATION IN THE RUWENZORI AND LAKE REGION, CENTRAL AFRICA.*

By Major R. G. T. BRIGHT, C.M.G., Rifle Brigade.

THE country described in this paper is in the neighbourhood of the western border of the Uganda Protectorate and the Congo State. The Anglo-Congolese Boundary Commission was directed to survey and report on the country adjoining the 30th meridian east of Greenwich. The field of operations was bounded on the south by German East Africa, and work was commenced on the plateau to the south-east of Lake Edward. The British commissioners proceeded westward to the

* With an appendix giving the co-ordinates of the trigonometrical stations, and the positions and heights of the peaks of Ruwenzori and Mufumbiro. A map by the British section of the Boundary Commission and a diagram of its triangulation accompany this paper. A summary report on the work of the expedition was published in the *R.G.S. Journal*, November, 1908. Read at the Royal Geographical Society, June 14, 1909. Map, p. 240.

Ruchuro, an unfordable river, rising in Mufumbiro and flowing into the southern end of that lake. They then travelled northwards along the eastern shore and crossed the narrow channel which connects the two lakes, Edward and George.

The name Albert Edward for the southern lake was a source of confusion between it and Lake Albert, and further there was no native name for its north-easterly arm. This arm has been called on some maps "Ruisamba," and on others "Dueru." Both of these designations were considered to be unsuitable, the former being an abandoned village on its shore, and which gave its name to a ferry long since disused, while the latter is a local word meaning "white" or "the shine of light," and is applicable to every sheet of water.

His Majesty the King has approved of Lake Albert Edward being called Lake Edward, and its north-easterly extension being named George after H.R.H. the Prince of Wales.

It was found to be impracticable to continue the survey over the snow-covered heights of Ruwenzori, so it was carried round the eastern side of the range. In the vicinity of Fort Portal, it was possible to erect a signal on a spur of the mountains, at an altitude of 10,000 feet. Karangora is the name of the peak, and even at this altitude the cold was intense, and it was swept by a bitter wind, driving rain or hail. In the mean time Lake George had been surveyed. From Karangora an extensive view is obtained over the valley of the Semliki (Etuli), so it was decided to return to Lake Edward, and coming back down the river Semliki, on the west of Ruwenzori, to thus complete the circuit of the mountains. From Lake Edward the British officers crossed the western spurs of the mountains and passed through the dense forest which covers the Semliki valley, and after linking together the surveys on the east and west of Ruwenzori they proceeded northwards to the Congo-Nile watershed.

The river Loia is shown on maps as an affluent of the Semliki, and thus belonging to the Nile basin. To decide the question as to whether we had actually reached the Congo-Nile watershed, Captain Iredell and Lieut. Weber of the Congolese section followed the Loia from its source to its mouth, covering a distance of 80 miles, and putting beyond doubt the fact that the Loia does not flow to the Simliki, but into a tributary of the Congo river. The watershed was then followed to the vicinity of the southern limits of the Lado Enclave. At a later date a party of the British section of the Boundary Commission passed along the eastern shore of Lake Albert and crossed the Victoria Nile at its mouth.

The 30th meridian had been followed as closely as was found possible during the journey from the south to Lake Albert, and suitable points had been selected for stations in the geodetic triangulation for the measurement of the arc of the 30th meridian. On the completion of

the actual survey of the boundary, a party of officers and non-commissioned officers were detached, and have completed this measurement from Lake Albert to the country a little north of the frontier with German East Africa. A portion of the expenditure to be incurred was generously subscribed by the learned societies of Great Britain, and two large theodolites were kindly placed at our disposal by the British South Africa Company. Captain E. M. Jack, Royal Engineers, was, since the commission left Africa, in charge of this work. It will be remembered that this scientific measurement was commenced some twelve years ago in South Africa under the direction of Sir David Gill, and has been completed to within 70 miles of Lake Tanganyika.

But a small portion of the country passed through can be said to have been absolutely unknown. In 1864 Sir Samuel and Lady Baker discovered Lake Albert. They first reached the lake near its southern shore, and proceeded northwards in canoes along its eastern waters. To the west Baker saw the dim outlines of mountains partially obscured in the mist, which he named the "Blue mountains," but he formed no conception that what lay southwards, hidden behind the veil, were the "Mountains of the Moon" with their snow-tipped peaks—in truth the most magnificent range of mountains in the whole vast continent of Africa.

Ruwenzori is seldom visible during the dry seasons. It, in conjunction with the surrounding country, is usually enveloped in thick haze; thus Stanley himself, when he discovered Lake Edward in 1875, failed to pierce the mist, although the range is visible for many miles south of that lake, and it was not until he was with the Emin Relief Expedition, in 1888, that he was rewarded by being the first European whose eyes were gladdened by the glorious sight.

Various explorers and travellers have passed through the greater portion of the country visited by the commissioners and collected much valuable geographical knowledge. Their maps, compiled together, formed a useful chart of these regions, though but two can be said to have done scientific surveys, and these are H.R.H. The Duke of the Abruzzi on Ruwenzori, and Captain T. T. Behrens, Royal Engineers, along the eastern shore of Lake Edward. Our results agree closely with those obtained by both, though it should be noted that it was not considered necessary for the commission to attempt cartographical work above the snow-line on Ruwenzori.

The Duke of the Abruzzi, in 1906, climbed the summit of Margherita, the highest peak of Ruwenzori, and also passed some six weeks in exploring the snow-covered regions. He measured a base, and the positions of the principal peaks were fixed by triangulation. His map is the only one of the snow-bound regions.

Captain Behrens, while serving with the Anglo-German Boundary Commission under Lieut.-Colonel C. Delmé-Radcliffe in the Uganda

Protectorate, made a map of the eastern shore of Lake Edward and the adjoining districts. This map was of assistance to the Commission. There is necessarily more detail in the work of the latter, but the topography of the two maps are very similar.

The staff of the British section were Brevet-Major (Temporary Lieut.-Colonel) R. G. T. Bright, C.M.G., Rifle Brigade, Captain E. M. Jack, R.E., and Captain the Hon. F. Prittie, Rifle Brigade. Mr. C. Chevallier joined as medical officer at Mombasa. Captain A. MacGregor, Royal Irish Fusiliers, and Captain S. Iredell, Munster Fusiliers, accompanied the troops detached from the 4th Battalion King's African Rifles to form the escort. Mr. J. Coates, Government geologist, was attached at a later date, and Mr. G. McCaw was sent out from home to aid in the measurement of the arc of the 30th meridian. Four British non-commissioned officers completed the commission.

The officers left England in the early days of January, 1907. There is no occasion to describe the now well-known route to Uganda *viâ* Mombasa, the Uganda railway, and across the Victoria Nyanza in a Government steamer to Entebbe, the headquarters of the Government of the Uganda Protectorate. There is in reality no such country as Uganda: the kingdom is officially known as Buganda, while the Uganda Protectorate comprises the kingdoms and countries under British rule in this portion of equatorial Africa. The Uganda railway lies thoughout its road in the East Africa Protectorate, and connects the Victoria Nyanza with the Indian ocean. The steamers on Lake Victoria supply, from the surrounding British and German possessions, the greater bulk of the commerce carried by the railway.

Leaving Entebbe, the expedition marched round the west of the Victoria Nyanza to Masaka, the Government station in Buddu, and thence to Mbarara, situated near the boundary. The distance from Entebbe to Mbarara is some 170 miles. Mount Ihunga was reached after a journey of five days from Mbarara, and then in the month of March the actual work of the commission was commenced. Ihunga and Chamiumba are trigonometrical stations in the triangulation of the Anglo-German Boundary Commission (1902–04), and the co-ordinates assigned to them were adopted as the starting-points for this commission. Chamiumba is situated a little to the south of parallel 1° S. and is in German territory, but permission was readily granted by the Imperial German Government for the station to be visited, and further they instructed their local authorities to give facilities to the British officers while in their colony. The longitude of these stations had been accurately obtained by the joint British and German Boundary Commissions in 1902–06, by a continuous triangulation from Zanzibar; the meridian of the latter place had been determined by telegraph from Capetown by Sir David Gill some years previously.

From a little north of Ihunga, to as far as can be seen south of it, is

a wild mountainous country, the summits of which are from 6000 to 8000 feet above mean sea-level. Portions of these mountains are densely wooded, and are everywhere intersected with precipitous valleys and ravines. The natives are for the greater part unaccustomed to Europeans, and sometimes hostile. Northwards, though still maintaining a highland character, it is open and much less wooded. In fact, in Kazara and Ruzumburu there are large tracts of country which are devoid of trees or even bushes. It is here chiefly a pastoral land populated by Bahima, with large herds of cattle. The plateau is about 1000 feet above the level of Lake Edward, cool and healthy, and the soil is rich and productive. Further north again, beyond the former British post at Karambi, the country is less suitable for cattle, becoming more broken and thickly covered with elephant grass and patches of dense forest.

Proceeding in a north-westerly direction, the British officers descended the escarpment to the Lake Edward depression. The lake is evidently shallow, and occupies but a portion of what must have once been its bed, and which in receding has left wide stretches of flat and often marshy land. Its basin is bounded on the east and west by a steep escarpment, which rises with remarkable abruptness from 1000 to 2000 feet above the adjacent low-lying land. At the southern end of the lake, and extending some 12 miles eastwards, is a plain covered with short thin grass and dotted with acacia thorn and euphorbia trees. Through this plain flows the river Ruchuro, from Mufumbiro mountain in the south, and loses itself in the lake and the rivers Ishasha and Chambo from the highlands on the south-east. There are not many inhabitants; the few there live either close to or on the lake (the latter a curious community, who pass an isolated existence on rafts), or else near the eastern escarpment. The country east of the north end of the lake is traversed by a few small streams. On the west is a range of mountains, apparently rising abruptly from its shores to a height of over 8000 feet, in the country Chaangu. Near Katwe, on its northern shore, is a group of small islands, one of which is thickly peopled. The total extent of this lake is some 49 miles in length by about 30 miles in breadth. It lies at an altitude of 3000 feet above the level of the sea. The water is unpleasant to the taste, but not salt.

Continuing northwards, Ruzumburu is a rich country, where quantities of food are grown, and the inhabitants own large herds of cattle. The eastern escarpment preserves its character until it gradually merges into the hills to the east of Fort Portal. The Mufumbiro volcanoes lie in lat. 1° 20′ to 1° 30′ S., and the positions of eight of these were trigonometrically fixed. The altitude obtained for the highest peak, Karisimbi, was 14,794 feet. These volcanoes were quiescent, with the exception of one lying a considerable distance to the south-west. Dense volumes of smoke rose from it, and its flame was

KIBERO, LAKE ALBERT.

CROSSING KAZINGA CHANNEL.

visible at night-time from Katwe. Owing to the extraordinary clearness of the atmosphere during the rainy seasons, Mufumbiro can be seen from the north for at least 120 miles. This name is applied to the whole of the volcanic region by the natives living to the north, who are aware of its existence. "Mufumbiro" is derived from three Bantu words meaning "Cook in place," and is the name given to the volcanoes on account of the smoke issuing from their craters. Captain Jack sketched the range from Nkabwe, and his drawing shows the relative position of the peaks to each other.

The personal relations between the British and Congolese officers were always cordial, and it was with considerable regret that we learnt in September that, owing to the bad state of his health, Commandant Mercier, the chief of the Congolese section, was obliged to return to Europe. Commandant Bastien succeeded him, and joined his section on the Nile-Congo watershed towards the end of the year.

A picturesque cluster of seven small lakes in the neighbourhood of Kibona occupy areas of subsidence formed by the outpourings of volcanic material. The two larger are called Nyamsigeri and Chaisanduku. Although the lakes are in close proximity to each other, in some of them the water-levels are at different altitudes, and there is no apparent connection between them.

The channel joining Lakes Edward and George was crossed in a fleet of canoes of sundry shapes, sizes, and degrees of "seaworthiness," or rather "unseaworthiness." They varied from large "dug-outs," capable of carrying fifteen men, to small canoes which barely contained one porter and his load. This winding channel has no perceptible current during the dry seasons, and varies from a quarter to three-quarters of a mile in width between its high banks.

To the north-east lies Lake George in an open country, in parts treeless, but covered with herbage varying from the thin "spear" to the thickest "elephant" grass, frequently 15 or 16 feet high. The sides of this lake are swampy, more especially on the north, where it is entered by the rivers Mubuku, Luimi, and Mpanga, all descending from Ruwenzori. The Mubuku runs through several channels, and has within recent years adopted a different channel for its main course. The swamp to the north-east was full of elephant, and a large herd of buffalo roamed with them. In the neighbourhood of Lake George, and especially on the lower slopes of Ruwenzori, the ground is pitted with old craters, some containing sweet water, others so saline that its smell can be detected at some distance, and again others which are dry. The Katwe salt lake is of value to the natives, and is worked by them. Large quantities of salt are extracted from it, and realize good prices locally, but it is not fit for European consumption. The salt appears to be derived from certain bands of tuff by percolating surface water which rises as springs in the bed of the lake.

The river Semliki flows out of the north end of Lake Edward along a broad shallow valley. At the south end the valley is open and there are no streams. Proceeding northwards, the country changes its vegetation. The valley and the lower slopes of Ruwenzori are covered with the densest elephant grass, and the elephant grass in its turn is replaced by forest. This eastern extremity of the great Etuli forest of equatorial Africa is often of the greatest density, though not always tropical in character. It is a dismal place, infested by stinging ants and insects, while the dampness and constant drip of water from the trees is wearisome in the extreme. The occasional glimpses of the sun through the thick foliage are welcome in the depressing gloom. Notwithstanding these disadvantages the forest is inhabited by the Baamba and Pygmies. The former live in numerous villages, and but for the tracks leading from one to another the forest would be almost impenetrable. The forest commences on the upper slopes of Ruwenzori, covers the valley, and spreads away to the west. When looked on from some height it presents an amazing and unending view of treetops, hiding the country beneath them as if it were covered with a dull green pall.

At the north end of the valley is again an open grass country, dotted with "candelabra" euphorbia and palm trees, and very flat. Through it the river flows broad and smooth, with many twists and turns, to Lake Albert. The Semliki is a fine river, from 60 to 100 yards in width, and would be navigable throughout its length during the rainy seasons but for the falls and rapids in the neighbourhood of the Congolese station at Beni. Its total fall is some 960 feet in its course of 155 miles, from 3000 feet, the height of Lake Edward, to 2037 feet, the level of Lake Albert.

Facing Ruwenzori on the west of the Semliki, hills rise, which, forest clad up to Mboga, northwards of there become open grass land, known as the Balegga hills. This is a cool, healthy, and fertile district, well watered and lying astride of the water-parting of the Nile and Congo.

Between the Semliki valley, connecting Lakes Edward and Albert, and the open plateau north of the Edward depression is the ridge of Ruwenzori, some 70 miles in length from south-west to north-east, and about 30 miles across in its widest part. At the southern end it subsides gradually into many broken foothills, but elsewhere it rises with astonishing suddenness from the undulating lands in its immediate vicinity. Its steepest slopes are on the western side, where also there is a far greater vertical fall than on the east. On its north and south extremities are found short grass and thorn trees only, but with that exception the mountains are almost entirely covered with thick forest, elephant grass, and bamboos, and, save where there are native paths, are practically impassable. The forest ceases at a height of a little over 14,000 feet, and above this are bare rocks, ice, and snow. Streams

descend from the glaciers through deeply scoured valleys on east and west. Below the snow region are a few small lakes.

But one small river, the Wasa, flows close to the eastern escarpment of the Semliki valley from Ruwenzori into Lake Albert. The river Mpanga rises in proximity to the source of the Wasa, but takes a southerly course to Lake George, which receives the drainage of the eastern slopes of the mountains. Similarly, the southern streams flow to Lake Edward and the western valleys drain into the Semliki.

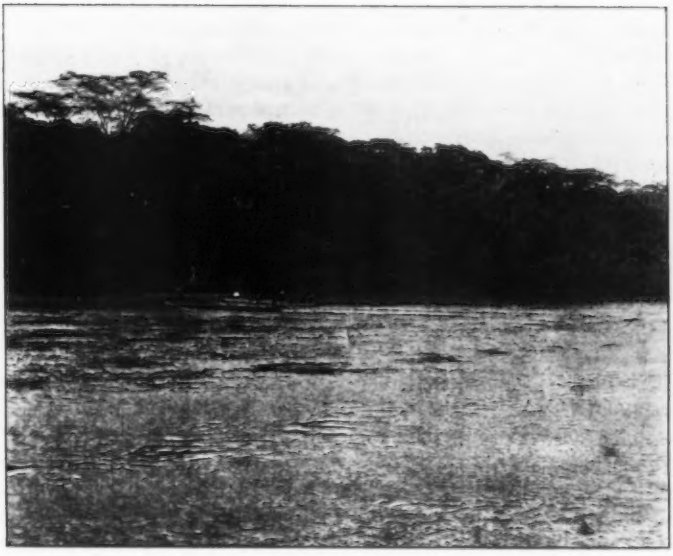
The snow-peaks of Ruwenzori, which form such a dominating and amazing feature in this latitude, are situated in an area of about 55 square miles in the central part of the mountains. They consist of three main groups, that reaching the greatest height being on the west, the other two respectively north-east (Johnston's Duwoni) and south-east of the first. Northwards are two smaller peaks visible from Fort Portal, and south is the chain of lower heights. The height obtained by us for the summit, Mount Margherita, was 16,794 feet, former heights were 16,618 feet by Captain Behrens, and by the Duke of the Abruzzi, 16,815 feet. Owing to the fact that the highest peaks are on the western side of the chain, they are obscured from view from the low ground on the eastern side by the intervening spurs and foothills.

The western side is, therefore, the best place from which to view the mountains. There they fall very steeply in numerous craggy precipices and forest-clad slopes, and from the neighbourhood of Beni a most beautiful view can be obtained. The pure white snow of the peaks glistening in the rays of the rising sun, or tinged with rose colour at the close of day, offer a magnificent spectacle to those who are so fortunate as to see them in the brief intervals in which they are clear.

The snow-line in the valleys comes as low as about 13,200 feet, but on the hilltops it appears to be higher, for no peak was observed of a less altitude than 14,600 feet that had snow on it, except temporarily. The mountains are, considering their impassable character, fairly closely inhabited. The Bakonjo live in neatly kept small villages in the secluded valleys, and up to a height of 7000 or 8000 feet. The range lies astride of the 30th meridian, which passes to the east of all the higher peaks.

Ruwenzori was crossed in several places by members of the British section; the highest point reached in one of the passes was over 10,000 feet, and that is the first time that the range has been traversed from east to west in its higher regions by a white man. The local natives have no name for the mountains as a whole, or for its peaks, but "Gambaligala" is the term applied to the range by the Baganda, and signifies "They me hurt;" probably referring to the strain caused to the eyes when looking up at great heights. "Ruwenzori" neither means nor conveys anything to a native's mind, and would appear to be derived from the Lutoro words "ru enjura," or "of rain."

NORTH-EAST OF LAKE EDWARD.



RIVER SEMLIKI.

Lake Albert lies to the north-east, and bears a strong general resemblance to Lake Edward. Their widths are about the same, though the former is double the length of the latter. On the west the mountains, which rise to an altitude of 7000 feet and over, fall sheer into the water along its extent as far north as the neighbourhood of the Lado Enclave, except for some 30 miles at the south end, where there is a stretch of flat land between the lake and the hills. On the east there is a similar escarpment, beginning from the eastern side of the northern spur of Ruwenzori, and rising perpendicularly in three steps up some 3000 feet from the Semliki valley; it curves round to the north-east and runs close to the lake till in the vicinity of Butiabwa, having decreased its height to only some 400 feet above the level of the lake, it then diverges eastwards, leaving a broad scrub-covered plain, which extends to the Victoria Nile.

The Victoria Nile enters Lake Albert at its north-east corner. The mouth is wide and mainly choked with "sadd" and papyrus, the navigable channel being near the left bank. Lake Albert gradually narrows at its northern end, where the waters of the Central African lakes flow northwards down the Bahr el Jebel to the Sudan and Egypt. Small lagoons, triangular in shape and formed by the silting up of sand, are a noticeable feature on the eastern shore of the lake.

A navigable lake of the size of the Albert must play an important part in the development of these countries. Unfortunately it does not possess many good natural harbours, with the exception of Butiabwa. Sudden and violent storms burst over its waters and make it unsafe for small raft. On the western shore Kasenyi and Mahagi Soghir are the only anchorages, and they are but sheltered from certain winds. On the eastern side Butiabwa is the best harbour on the lake. It has deep water and is well protected. In addition to Butiabwa there are harbours at Tonia and the bay at the south end, while the entrance of the Victoria Nile is well sheltered. The water is drinkable but not good, and, it is curious to say, less disagreeable to the taste on the eastern side than on its opposite shores.

The Victoria Nile is navigable by small steamers to the Murchison falls, and the Bahr el Jebel is an open waterway to Nimule. Canoes can pole up the Semliki river to the rapids near Beni.

Rising gradually from Lake George to Fort Portal, a great plateau stretches northward to Hoima, the capital of Bunyoro. This land is from between 2000 to 3000 feet above Lake Albert. The river Muzizzi flows through a broad valley which drains most of the country north of Fort Portal, and debouches into the south-east corner of the lake. It is a small stream, and fordable in the dry season, but becomes a considerable volume of water during the rains, and is a serious obstacle to cross. Between the Muzizzi and the river Ngussi the kingdom of Buganda extends to the Albert, while to the north of the latter it is in Bunyoro.

The Bugoma forest occupies a considerable portion of the plateau. The area covered by large timber is not great, but the wood straggles in all directions, and is intersected by open glades and patches of thorn bush. There is but little water in this district during the dry weather, and it appears to be almost uninhabited. Several species of rubber vine are found in the forest, of which *Landolphia Dawei* is of commercial interest. *Funtumia elastica*, the Lagos silk rubber tree, is scattered through the forest. A species of Alstonia is common; the wood is light, and is used by the natives for making bowls and the backs of string instruments.

Kibero is an important village within a short march of Butiabwa. At the former large quantities of salt are procured from the springs, and a considerable trade in this commodity is done with the interior and also with various places on the lake. Canoes ply across the water with salt to the Lendu country.

The strip of the Anglo-Egyptian Sudan on the west of Lake Albert was the least-known region visited by the expedition, and is therefore dealt with in more detail. A wooded plain stretches from the south-west corner of Lake Albert to the foot of the Balegga hills. This plain is only a few feet above the level of the lake; it is thinly inhabited and sparsely cultivated. During the wet season there are large numbers of mosquitoes (Anopheles), and consequently a good deal of fever. The tsetse fly (*Glossina morsitans*) is prevalent, but none of the Palpalis species were seen, nor is there any sleeping sickness. In the northern portion of the low-lying country is a forest, which, as it is near the lake, is of value for a supply of fuel for the steamers. One of Emin Pasha's steamboats, the *Khedive*, which was used by him in collecting his people to accompany Stanley's Relief Expedition to the coast, lies sunk near the shore at Kahanama. Parts of her have been recovered, and from the state of almost perfect preservation they are in, it would seem that in all probability she is in fairly good repair. The steamer was not wrecked, but purposely scuttled by the men in charge of her, and cannot have been materially damaged.

The Balegga mountains rise precipitously from the plain to a height of 5000 feet, with peaks of an altitude between 7000 and 8000 feet. The water-parting of the rivers Nile and Congo follows the highest line of the mountains, and is some 9 miles from the south-west corner of Lake Albert. It then swings round till at Korovi hill it is not more than some 5 miles from the shore, and continues near the lake to the southern limit of the Lado Enclave. The country in the mountains is a charming one; the grass is generally short, and it is easy to travel from one place to another. Following the watershed, even in the middle of a dry season, one could not fail to be struck with the plentiful water-supply. Northwards of Korovi there are but few native paths and no game tracks, so travelling is by no means an easy task. There are patches of dense

forest, and the hills are covered with elephant grass. These generally slope steeply down to the lake-shore. Further north are Mounts Ajo, Ani, and Rueti. A broad uninhabited valley, watered by numerous small streams, lies between Ani and Ajo. Near the latter is Bushwa (Mahagi Kebir), on a patch of rich land a few square miles in extent, which some years ago was occupied by a British garrison. Looking to the north-eastwards from Abura (north of Rueti and Ajo), the country appears to be hilly and wooded. At Mahagi (Soghir) there is a Congolese port, and near by a Congolese garrison is stationed.

Two days' march westwards from Korovi are the gold-mines of Kilo. These mines are the property of the "Domaine de la Couronne," and appear to be of value. Recently consignments of bullion to the value of about £48,000 have been despatched from them through the Uganda Protectorate for shipment at the coast to Europe. The gold is alluvial, and up to the present the actual reef has not been located. Further deposits are said to have been discovered more to the west in the Independent State of the Congo.

In the short and narrow strip of country from the southern shore of Lake Albert to Mount Abura the inhabitants differ widely. The plain and hill as far north as Korovi are peopled by the Balegga, who are of Bantu stock. They are a friendly and peaceful tribe, extensively cultivating some of the mountainous districts and growing sweet potatoes, matama, millet, Indian corn, and ground-nuts. Elephant and wart hog, more especially the latter, which commit such destruction to the crops in Toro, do not exist here. Indian corn is grown in large quantities in the plain around Kasenyi. The country is divided into chieftainships, each owning a small portion of littoral, and their countries are thus easy of access from either Bunyoro or Toro. The chiefs are descended from the same branch of the Galla which has produced the aristocracy of Bunyoro and the neighbouring kingdoms to its south.

The Bavira are closely allied to the Balegga, and are noticeable by their women wearing a particularly disfiguring ornament in their upper lips—an embellished wooden disc from $2\frac{1}{4}$ to 3 inches in diameter. These tribes barter their food for beads and cloth, much preferring the latter, though they are but scantily clothed. The males wear a piece of cloth carried between the legs, with its ends tucked, both in front and behind, through a belt of hide or rope, and for ornaments ivory and wooden bracelets. With the women a bunch of weeds worn behind is all that is considered necessary, though their necks are encircled with many strings of different-coloured beads. The young men and women dress their hair with a mixture of light clay. The weapons in use by the Balegga and the Bavira are spears and bows. The former carry leaf-shaped iron heads from 8 inches to 1 foot in length, while the bows are small; the string being a strip of untwisted bark, sometimes bamboo.

The arrows are ornamented and feathered with a leaf; they have small iron heads which are not poisoned.

Korovi appears to be the meeting-point of the Bantu and Nilotic peoples. The country to the north is inhabited by Lendu, a finer and a darker race than either the Balegga or Bavira. The Lendu are warlike, and are continually fighting amongst themselves or any one else they think they are strong enough to overcome. They are treacherous, and will go to almost any extreme in their anxiety to obtain arms and ammunition. There is little intercourse between the Lendu and the Balegga, and it was difficult to find a Mulegga who, though living near them, could understand their language. The dress of the Lendu is identical with that of the Balegga, except that beautifully tanned goatskins trimmed with beads replace cloth, which is almost unknown. They will readily accept beads in exchange for their food-stuffs. Their bows and arrows are similar to those of the Balegga, but their spears are of the Nilotic stabbing pattern, having a small leaf-shaped head, with a long iron shank and long shaft. They also possess rifles and ammunition. The inhabitants near the lake catch a considerable number of fish with rod and line from their canoes, and kill hippopotamuses, depending largely on them for their food-supply.

There is iron ore in the highlands, which is smelted for the making of weapons and agricultural implements. The furnaces are neat and ingenious, the bellows being made of goatskins and worked with sticks. A little salt is procured from washing the soil near Kasenyi, but it is of a poor quality.

In the mountains an extraordinary absence of animal life is noticeable; except in the valley between Ajo and Ani, which is visited by elephant in the wet seasons, the country is destitute of wild animals and birds. The lowlands are, however, rich in game. Elephant, Uganda, cob (*Cobus Thomasi*), water-buck (*C. defassa*), buffalo (*Bos caffer*), bush-buck (*T. Scriptus typicus*), and the common duiker (*Cephalophus grimmi*) are found. Guinea fowl are plentiful, and excellent fish are caught in the lake. Lake Albert swarms with hippopotamuses and crocodiles, more especially at the mouths of the small streams.

The difference in level between the Victoria and Albert lakes has been found by the Uganda Survey and the Egyptian Survey to be 1690 feet. Their results were in very close agreement. The Edward is at a level of 727 feet below Lake Victoria, and the Albert was found to be 963 feet lower than the Edward, which makes the trigonometrical heights of the Anglo-German Boundary Commission along parallel 1° S., and those of the present Commission from thence to Lake Albert, agree closely with the levels of the Uganda and Egyptian Survey Departments for Lake Albert.

The main sources of the Nile in Lake Victoria are husbanded and the waters held back by the Ripon falls. Again, after it has been joined

by Lake Chioga (Ibrahim) the water is contained by the Murchison falls before reaching the natural reservoir, Lake Albert; so the flow northwards from the Edward, and, as has been previously explained, the greater portion of the drainage of Ruwenzori, descending as it does through that lake, is held back by the falls and rapids on the Semliki, near Beni. The Lakes Edward, George, and Albert form large natural reservoirs for the supply of the White Nile.

Mr. Coates found the country from lat. 40′ S. to parallel 1° 37′ N. to be occupied by a mass of granite and gneiss and a series of crystalline rocks of indeterminate age, overlain in the sunken areas of Lake Edward and the Semliki valley and in the depression containing Lake George by alluvium, and in four small detached districts by volcanic rocks. The high plateaus of West Ankoli and Toro consist mainly of gneiss, with intercalations of schistose rocks and bands of quartzite. Over the greater part the gneiss has a uniform north north-west strike, and the intercalated bed strikes in the same direction and dip vertically. The Balegga hills are a mass of granite, intersected by numerous basic dykes, with accompanying fault-breccias, which afford evidence of the faulting and subsidence which have occurred there.

The foothills of Ruwenzori consist of quartzite, quartzose schists, sheared quartz-felspar rocks, with intercalations of epidiorite and amphibolite schist. These are succeeded by a thick mass of lustrous mica-schists, which rise in numerous sharp ridges and jagged peaks in the intermediate part of the range surrounding the loftiest peaks. The highest parts of the mountains are formed of flat sheets of amphibolite and amphibole-schists and gneiss, dipping conformably under the mica-schist. The distribution of old moraine stuff points to a much greater extension of the glaciers in former times. Volcanic rocks occur in the districts of Kichwamba, Katwe, Kyatwa, and Fort Portal. The remains of numerous tuff-cones and funnels occur, together with circular vents, probably drilled by explosive gaseous eruptions and largely depressed areas of subsidence. The volcanic ejecta in all these districts consist almost entirely of tuff and agglomerates. The Fort Portal belt is the least developed of the volcanic areas. A thin layer of tuff is exposed on many of the gneiss-topped hills, forming on the lower slopes a mantle from which protrude the rounded masses of gneiss forming the hilltops. These volcanic systems seem, by their position and strike, to be connected with the fractures bounding the Semliki valley, which is generally admitted to be a trough subsidence, or rift-valley, between roughly parallel faults, and with the subsided area now occupied by Lake George. Both of these low-lying areas are covered with recent alluvium, mainly derived from the Ruwenzori mass.

Recent-looking shallow-water deposits, comprising quartz-gravels, sands, and sandy clays, with bands of glauconitic sand, layers of ironstone with organic structure, and some seams of bituminous lignite, lie

NILE-CONGO WATERSHED ON THE BALEGGA HILLS.

A CRATER LAKE IN TORO.

in two belts under the escarpments on either side of the Semliki valley, near the south end of Lake Albert. From the intercalations of ground and the frequent occurrence of false bedding, they appear as shallow-water deposits, and point to a former extension of the lake in a southerly direction. Evidence of a more recent elevation of the land relative to the water is furnished by the raised beach which extends along the lake shore from Kasenyi to Kahanama.

Several hot springs were seen on the banks of the Chambo river, near parallel 1° S., rising within a few feet of the flowing water. Another large spring is on the east of Ruwenzori, in the Luimi valley, while in another at Branga, on the opposite side of the mountains, the water is boiling. These mineral springs are resorted to by the natives for the treatment of rheumatic disorders, but the waters are not drinkable.

The open grassy downs on the Ankoli plateau are covered with herds of big-horned Hima cattle, but, with the exception of a few duiker (*C. grimmi*) and leopards, there are no wild animals. Birds were more plentiful; of these the most noticeable were batteleur, crested eagles, and many varieties of hawks. Lake Edward is usually supposed to be free from crocodiles, and none were seen by any member of the commission. There are, however, some of these reptiles in the lake. The open plains south of the lake swarm with game. Though it is so abundant, the inhabitants take no steps to kill or trap anything. Even the wart-hog (*Phacochœrus æthiopicus*), which are so common along the lake-shore, are allowed to grub unmolested in the miserable patches of cultivation near the villages. On the north, Katwe is notable for the numbers of reedbuck in its vicinity.

The district between the Congolese stations, Kasindi and Beni, is an ideal elephant country, and is tenanted by some large herds. The Etuli forest and the wooded slopes of Ruwenzori form veritable strongholds for elephant, while in the Toro Game Reserve devastated plantations and spoor testify to the numbers still living in and around the protected country. In the open country on the southern shore of Lake Albert when the plains are marshy, elephant and buffalo roam over them. The river Semliki is here tenanted by numberless hippopotamuses and crocodiles, the former of which are a danger to the canoes of the natives. Lions enter the station at Fort Portal during the wet season, but apparently do little damage to human life or domesticated stock. They subsist mainly on the wild pig, a great scourge to the native's cultivation, and it is said that the natives prefer lions to the destructive wart-hogs, and are chary of giving information to enable them to be hunted.

On the plateau to the east of Lake Albert elephant and buffalo are plentiful, and also Uganda cob, water-buck, and Jackson's hartebeste (*Bubalis jacksoni*) were seen in some numbers. The rivers Muzizzi and

Ngussi are the dry-weather quarters of a large number of elephants. Stanley, in 1889, found kudu and roan near Kavalli's on the west of Lake Albert, but these have long since been killed off, presumably by the natives. The okapi is said to be common in the forest not far from Irumu, the Congolese station in this district.

The kingdom of Ankoli may be said to stretch so far westwards as the shores of Lake Edward. Though on its borders other Bantu peoples are found, the population can be roughly classified as the Bahima, the aristocracy, and the Baero, the cultivators and serfs. When the Galla invaders drifted down from the north they established a powerful branch of the Hamitic family in Ankoli, also supplying the neighbouring kingdoms of Toro and Bunyoro with their royal families and aristocracy. In appearance the Muhima is different from the surrounding natives. Except for his hair, which, although tightly curled and growing in tufts, is not so woolly as that of the negro, he might be mistaken for a very dark Egyptian. In some cases the features are strikingly aquiline, and, united with a tall lithe figure and small hands and feet, combine to make the Muhima a handsome man. The Baero, on the contrary, are of Bantu stock, and there can be no doubt they are a negroid and inferior race.

The Bahima believe vaguely in an all-powerful Deity, who is associated mainly with rain, thunder, and other weather phenomena. They endeavour to propitiate various devils, most of whom are connected with the prevalent diseases, by erecting joss-houses, in which food and beer are placed. They invariably carry round the neck wooden charms or small goats' horns, which have been invested with magical power by the medicine men, and usually wear wire bracelets and anklets. The women are not prolific, and it seems likely that this fine race will be one day indistinguishably blended with its negro neighbours. The Bahima, like their distant relatives the Masai, are a purely pastoral people. All forms of agriculture are held in contempt, and are relegated to their Baero servants. In sharp distinction to most of the natives of this part of Africa, the Bahima do not practise circumcision or any scar ornamentation. The Bahima make very graceful pottery to carry milk or beer. The vessels are blackened with plumbago, and are frequently ornamented with deeply-cut designs. Some excellent basketwork is also turned out. There are smithies and smelting furnaces for the manufacture of weapons and agricultural implements. The bellows employed differ greatly from the skin ones of the surrounding tribes. A pipe is carried to the furnace from a baked clay pot, over which a skin attached to a stick is fastened. The pressure is obtained by working the stick up and down. Attempts are being made to encourage the natives in the industry of collecting bees'-wax.

The Baero are agriculturists, and until recently were not allowed by the Bahima to keep cattle. They cultivate bananas and various cereals;

tobacco is also grown. They are hunters, and net game of all kinds. In contradistinction to the Bahima, they display a scrupulous decency as regards clothing; but, as is often the case in Africa, this does not mean a correspondingly high state of morality, their morals being nil. To the Bahima devils the Baero add a considerable number of their own, the most important being Magasa, who eats their bananas in great quantities. Their custom is to bury their dead; contrary to that of the Bahima, who put out the corpses to be eaten by hyena. Murders are constantly committed, human life being held of small account.

The hilly country to the west of Ihunga is inhabited by a tribe who call themselves Bachigga, and their country Rukigga. This tribe is of Baero stock, but of a lower degree of civilization. It was difficult to get to know these people, as on the appearance of a white man every native fled to the hills, carrying any property that could be quickly collected. They have no chiefs, but manage their affairs by families. Their country is disturbed by constant feuds between village and village, and is poor and unproductive.

The Bakenjo are of Bantu origin, and are found along the shores of Lake Edward and on the slopes of Ruwenzori. In appearance they resemble the Baero, but are not so large. They make sturdy porters, being able to ascend the Ruwenzori mountains to heights to which no other natives can attain. At Katanda, on the eastern shore of Lake Edward, is a village of lake-dwelling Bakonjo, who are said to be afraid to live on land owing to the number of lions.

The islands in the north-east of Lake Edward are used as distributing markets. The inhabitants have no means of livelihood except by trading. Salt is carried in canoes from Katwe, and sold to the natives at marketing prices on the lake-shores. The salt belongs to the mainland people, but the islanders act as merchants, and charge commission, which is paid in food. The Bakonjo are peaceful and friendly, very different from their neighbours, the Bachigga, or Basiggi. They are a moral race, but have no other religion than the mild devil-worship common to the Ankoli people. Their industries are the usual pottery, basket-making, and iron smelting. The mountain Bakonjo usually wear monkey or hyrax skins thrown across the shoulders, which form but a slight protection from the cold. The natives of Brezu and the eastern littoral of Lake George are the Bagabu. They are almost identical with the Baero, but depend to a considerable degree on fish for food, and are fearless hippopotamus hunters.

The Kichwamba people are descended from some Baganda murderers, who fled their country and settled in Bunyaruguru. They have, through long residence among Baero, become Baero themselves. They, however, plant their bananas like the Baganda, have churches and schools for their boys and girls, and are a thriving community. A sect of witch doctresses, whose chieftainess is Chabisa, and which calls itself Niawingi,

COTTON GROWN IN TORO.

LAKE NYAMSIGERI.

has obtained great influence in western Ankoli. This power is, unfortunately, hostile to European influence, and is used mainly to stir up strife. Mbuigue, a famous doctress in Ruzumburu, has immense power, as all questions of importance are referred to her.

The peoples living to the east of Ruwenzori and of the Albert lake are so closely allied that it is unnecessary to deal with them separately. The aristocracy are, as in Ankoli, of Hima blood, but the Mutoro peasant is of a rather more degraded type than the low-class Munyoro. The latter people show traces of a considerable infusion of Hamitic blood.

Christianity is making great strides in both the kingdoms of Toro and Bunyoro, though amongst the uneducated the same vague belief in a spirit who manifests himself mainly in weather phenomena, which obtains among the Baero, is found; also the same devils have to be propitiated. Circumcision is not practised by the Bunyoro, but is common with the Batoro and Bakonjo on Ruwenzori. With the latter tribes it seems in some way to serve as a bond of brotherhood. The Bunyoro have an unpleasant custom of extracting the four lower incisors, which causes the upper teeth to grow forward, imparting to their mouths an unbecoming rabbit-like appearance.

Daudi Kasagama, King of Toro, was crowned for the first time in 1908. The ceremony was an interesting semicivilized and semibarbaric function, which was well arranged, and passed off so successfully that the king proposes to hold a coronation every year. His father, the late king, was crowned each month till he was deposed by the warlike Kabaregga of Bunyoro. Kasagama is a very intelligent and progressive man, who applies himself industriously to the well-being and improvement of his country.

Basketwork is quite a fine art among these natives. Vessels for carrying food, covers for jars, trays, etc., are made. These are often of the finest workmanship, and colours are introduced with good effect. Needlework has hitherto been practised by men only; they make fine coloured braids for trimming native dresses. Under European teaching, a certain number of women are being taught lace-making, with results that so far, though small, are good. Iron is worked in all the hilly parts of the country, where ironstone abounds. The only articles forged are spear and arrow-heads, personal ornaments, and hoes. Attempts are being made by missionaries and others to get the people to practise the industry of iron-working more; but with the advent of European-made articles, it is becoming increasingly difficult. Copper ornaments are worn, but no evidence was seen of its being worked by the natives.

Wheat has been cultivated in Toro, and also a small quantity of cotton is being planted, while in Bunyoro, owing to the better facilities available for transport to the Victoria Nyanza, it is being extensively grown.

Commerce in hides is carried on, the skins of cattle and goats being obtained from natives by purchase or barter and conveyed to Buganda for sale. A considerable carrying trade occupies a proportion of the natives of Toro. Ivory and rubber from the Congo, small quantities of the same from British territory, are constantly being conveyed to Buganda for shipment by the lake steamers to the Uganda railway. Everything is carried on the heads of porters; no wheel or motor traffic has yet been introduced in this country.

The roads are entirely native made, occasionally under European superintendence, but when their construction has not been under white supervision they show a careful disregard of all engineering principles. Still they form a great relief to following the ordinary native or game track. Along the main roads "rest-houses" are built and maintained by the local chiefs. These houses would form suitable places for camping, but they are infested with the tick, which, when once infected, conveys relapsing or spirillum fever.

The Baamba are a Bantu race, who live in the forest near the Semliki river. They are smaller in stature than the Batoro and lighter in colour; they have better features than the usual Bantu negro. This tribe is addicted to cannibalism of a particularly loathsome form. Families exchange their young children, who are then eaten. The Baamba in many cases file their teeth, but this practice is not quite general. They are a jovial people, and many of them talk Kiswahili, doubtless learnt by them from the Manyema slave-traders, who used to live in these parts.

A constant warfare goes on between village and village. They are built on the top of a ridge, and a stout wooden stockade is erected round. The approaches through the forest are difficult, as trees are felled across them, and in war time sharpened wooden skewers are planted to injure the feet of the attackers. Each village has a club-house, furnished with a few rough three-legged chairs, made of the forked boughs of a tree, on which the members lie; the men gather here to talk and smoke. Some rubber grew in the forest, but the natives collected it, tapping the vines unscientifically, with the result that they have been destroyed. The Baamba fear the pygmies; these little people do not cultivate, but prey on the crops of their larger neighbours, and in return do them service when fighting and hunting.

The Batwa or Bambutu inhabit the forest on both sides of the Semliki. They stand about four feet high, and are long armed, short legged, and ugly, being usually prognathous. The legs are disproportionately short, the feet large, and the body is covered with a sort of down. Both sexes affect a state of complete nudity. They have their own tongue, but usually know a little of the languages of their big neighbours. No attempt is made to till the open forest glades; they depend for food on game, and what they steal from the fields and plantations of the

surrounding tribes. Though there are several different tribes of pygmies, they appear to have no tribal organization. It is the custom for a group of families to attach themselves to a negro chief, and, in return for food, to assist him to fight his enemies. The standard of morality of these little people is high, and, strange to say, they are remarkably intelligent.

The wild beasts living in this forest are killed for food, even the elephant. Pit-falls, snares, and heavily weighted spears are used, but their favourite way of hunting an elephant appears to be with bow and arrow. Poisoned arrows are shot into him, and the great beast is followed until he falls, when the little hunters camp round the body and feast on the carcase until it is finished.

Yet another tribe inhabits this forest area. The Banande appear to be related to the pygmies, but not of them. They are larger and more Simian in appearance. These pygmies are found in ones and twos hanging round the Baamba or Bavira villages; it seems that they are pariahs, literally living on what they can pick up.

In the more unhealthy places through which the Commission worked, such as the Semliki valley and the south end of Lake Albert, cases of acute fever occurred, which Mr. Chevallier considered were certainly not relapsing fever, and were probably not malaria, nor were they dengue or acute rheumatism. A few days' march further north at Kasenyi Mr. Chevallier noted another series of interesting cases. These were affections of the nervous system, all of them of a temporary character, and in the majority of patients following acute illness. To call it beri-beri is an insult to a classic disease, and with the exception that the nervous system was affected bore no resemblance.

Northwards of Butiabwa the country is being devastated by sleeping sickness. Arrangements were, however, being made by the Protectorate Government for the removal of the inhabitants out of the fly-stricken zone to a healthy area. The shore of the lake to the south is infested by both *Glossina palpalis* and *Glossina morsitan*, but it is free from sleeping sickness, probably owing to the fact that there are not many inhabitants, and the former fly has not yet become infected. Southwards of Lake Albert, it is satisfactory to note that all through the country no cases of sleeping sickness were seen; unfortunately, this is no guarantee that this part will continue free from the disease. Tsetse fly belts are common along the lake-shores wherever bush grows near the water's edge, and spreads up the banks of the rivers flowing into the lakes.

During the latter months of the Commission Captain Jack, Mr. McCaw, and M. Dehalu, assisted by Captain Wangermée of the Force Publique of the Independent State, had completed a portion of the geodetic measurement of the arc of the 30th meridian. M. Dehalu had been specially sent out from Belgium by the Congolese Government to co-operate with the British in this work.

By July of last year the Commission had finished its labours, and, with the exception of those officers and non-commissioned officers who were to remain with Captain Jack, it returned to England. The reports and notes of Captain Jack, Captain the Honble. F. Prittie, and Captain Iredell, and a geological report by Mr. Coates have been extensively used by me in the preparation of this paper, and I desire to express my indebtedness to them,

APPENDIX.

Co-ordinates of Trigonometrical Stations.

Name.	Latitude.	Longitude E.	Height.
	° ′ ″	° ′ ″	feet.
Chamiumbu	S. 1 0 13·624	30 8 19·108	6,167·0
Ihunga	S. 0 59 41·404	30 2 31·037	7,175·0
Kasomora	S. 0 51 3·034	30 3 49·306	5,088·7
Kasese	S. 0 52 32·763	29 54 23·839	5,834·3
Itembi	S. 0 47 40·185	29 59 18·140	6,363·7
Karerema	S. 0 58 11·053	29 50 58·254	7,616·8
Ruankoba	S. 0 44 54·611	29 51 46·679	5,392·8
Nkabwe	S. 0 54 2·137	29 35 14·291	6,165·4
Kamorora	S. 0 40 51·885	29 37 17·586	3,547·8
Kabali	S. 0 39 45·332	29 27 53·779	3,022·3
Kitimbo	S. 0 32 47·008	29 39 0·477	3,153·3
Izumu	S. 0 38 46·226	30 2 36·049	5,814·5
Kati	S. 0 37 36·998	29 56 29·249	5,279·5
Buambara	S. 0 36 1·559	29 47 57·206	3,717·9
Kitampungu	S. 0 24 4·748	30 2 0·372	5,456·0
Bushabwanyama ...	S. 0 18 28·935	29 52 38·073	3,354·2
Kibona O.S.	S. 0 13 33·741	30 3 6·660	3,143·6
Chekoba	S. 0 15 41·266	30 4 9·890	4,648·9
Naluziguti	S. 0 7 0·691	29 55 13·917	3,493·6
Kitoma	S. 0 4 58·270	30 10 10·386	3,090·8
Chamatum	S. 0 1 49·993	29 56 32·252	4,479·4
Kahochi	N. 0 3 52·817	29 59 25·096	5,087·8
Kasazu	N. 0 7 9·845	30 10 39·666	3,018·7
Nkenda...	N. 0 14 48·270	30 5 58·433	5,532·4
Kavandara	N. 0 15 28·556	30 19 14·103	4,730·2
Haragatwe	N. 0 1 50·630	30 19 28·962	4,369·2
Kyatwa	N. 0 26 30·797	30 13 1·381	5,164·4
Kasangari	N. 0 27 27·149	30 5 34·284	7,421·4
Karangora	N. 0 38 4·444	30 7 18·163	9,886·6
Njara	N. 0 40 4·056	30 17 11·464	5,201·0
Msandama	N. 0 44 50·929	30 10 3·255	7,995·7
Kiduru	N. 0 45 42·192	30 21 58·976	5,561·0
Behanga	N. 0 56 40·494	30 18 0·671	2,415·4
Kieru O.S.	N. 0 57 27·869	30 10 40·074	2,126·0
Isura	N. 1 10 40·357	30 11 14·897	5,844·5
Kalevi	N. 0 58 19·330	29 54 0·212	5,057·8
Mikora	N. 1 18 1·614	30 3 38·219	6,306·0
Lagora	N. 1 25 56·686	30 18 22·447	5,357·2
Liangu	N. 1 35 14·234	30 10 6·794	4,343·0
Nyamavi	N. 1 20 7·387	30 23 51·276	3,036·8
Korovi	N. 1 39 40·427	30 35 56·158	7,117·8
Pikoti	N. 1 37 23·431	30 24 20·114	6,495·3
Ani	N. 1 49 52·444	30 47 19·950	7,165·8
Ajo	N. 1 55 37·697	30 47 58·072	7,945·2
Naroambo	S. 0 11 37·935	30 5 59·908	3,493·0
Kasooni	S. 0 51 47·525	29 41 4·868	5,391·1
Mbirembu	S. 0 3 11·221	29 40 29·194	4,279·6
Karemia	N. 0 5 30·100	29 42 38·983	5,646·2

Name.	Latitude.	Longitude.	Height.
	° ′ ″	° ′ ″	Feet.
△ Mirego	N. 0 6 33·329	29 38 50·611	3,207·8
△ Hangi	N. 0 9 54·777	29 43 29·586	5,854·5
△ Libona	N. 0 22 13·303	29 36 21·700	3,812·1
△ Vyatungu	N. 0 27 2·549	29 46 21·114	5,874·7
△ Poruo	N. 0 52 58·387	29 43 9·098	4,406·7
△ Bome	N. 0 34 56·779	29 52 5 821	4,248·7

Lake Albert	2037
Lake Edward	3000
Lake George	3000

POSITIONS AND HEIGHTS OF THE RUWENZORI AND MUFUMBIRO PEAKS.

Ruwenzori

Name.	Latitude.	Longitude E.	Height.
	° ′ ″	° ′ ″	feet.
⊙ Margherita	N. 0 23 7	29 52 16	16,794 *
⊙ Alexandra	N. 0 23 2	29 52 13	16,726 *
⊙ Moebius	N. 0 22 38	29 52 17	16,159 *
⊙ Elena	N. 0 22 26	29 52 29	16,345 *
⊙ Savoia	N. 0 22 24	29 52 38	16,421 *
⊙ Umberto	N. 0 25 40	29 53 53	15,754 *
⊙ Kraeplin	N. 0 26 8	29 53 55	15,724 *
⊙ Weismann	N. 0 19 45	29 53 8	15,163 *
⊙ R_2	N. 0 19 5	29 52 44	15,000 *
⊙ R_4	N. 0 18 36	29 52 15	14,976 *
⊙ R_{17}	N. 0 18 20	29 52 14	14,862 *
⊙ R_6	N. 0 6 44	29 58 56	6,074
⊙ R_{14}	N. 0 31 55	30 4 12	10,624
⊙ R_{15}	N. 0 29 10	30 1 22	12,651
⊙ R_1	N. 0 4 28	29 48 40	7,099
⊙ R_{10}	N. 0 6 14	29 48 26	7,724
⊙ R_5	N. 0 11 9	29 51 23	11,474
⊙ R_3	N. 0 16 5	29 52 19	13,903
⊙ R_{16}	N. 0 15 4	29 54 57	13,213
⊙ R_9	N. 0 18 11	29 52 57	14,377
⊙ R_{21}	N. 0 23 0	29 50 10	14,616
⊙ R_{19}	N. 0 15 41	29 54 20	13,682
⊙ R_{20}	N. 0 26 52	29 48 46	11,429

Mufumbiro.

Name.	Latitude.	Longitude E.	Height.
	° ′ ″	° ′ ″	feet.
⊙ Muhavura	S. 1 22 58	29 40 34	13,493
⊙ Mgahinga	S. 1 23 3 1 23 12	29 38 39 29 38 32	11,400
⊙ Sabyino	S. 1 23 21	29 35 20	11,955
⊙ Nambagira	S. 1 23 21 1 23 23	29 33 39 29 33 21	9,837
⊙ Visroke	S. 1 27 26	29 29 1	12,166
⊙ Karisimbi	S. 1 30 22	29 26 55	14,794
⊙ Mikeno	S. 1 27 47	29 25 7	14,547
⊙ Viragongo	S. 1 31 26 1 31 7	29 15 11 29 14 36	11,360

NOTE.—Where two positions are given they are of two points roughly east and west on crater edge.

* Snow-peaks.

EASTERN SHORE, LAKE ALBERT. (RAPID TRIANGULATION.)

Name.	Latitude.	Longitude E.	Height.
	° ′ ″	° ′ ″	feet.
△ Kagora	N. 0 46 59·5	30 39 9·5	5,393
⊙ Dwangidiri	N. 1 5 48	30 39 37	3,944
△ Munuanpungu ...	N. 1 3 6	30 55 31	4,304
△ Birembo	N. 1 15 15	31 6 10·5	4,677
⊙ Kouamara	N. 1 19 27·5	30 50 16	3,909
⊙ Kavakete	N. 1 28 12	31 3 9	3,794
△ Mukehani	N. 1 29 24	31 21 47	4,729
△ Bulembo	N. 1 41 41	31 19 6·5	3,492
⊙ Mahangaisima ...	N. 1 17 6	30 56 59	4,162
⊙ Kabendi	N. 0 53 43·5	30 28 7	4,920

Before the paper, the PRESIDENT: Major Bright, who has kindly consented to lecture here to-night, has had very wide experience in Africa. He has been employed for almost the whole of the last twelve years in survey work in the Sudan, in East Africa, and in Uganda, and he has served with, and under, various distinguished officers—Colonel Sir J. R. L. Macdonald, Colonel Delmé-Radcliffe, Major Austin, and Major Smith. For his excellent work on the Anglo-German Boundary Commission he was given the Back Grant in the year 1906; and in 1907 he was appointed chief of the Anglo-Congolese Boundary Commission. The duty of that Commission was to map the disputed line of demarcation between Uganda and the Congo State, and that work has been completed. On him also fell the duty of taking the preliminary steps with regard to the measurement of the arc of the meridian from 1° 10′ S. to 1° 10′ N. for geodetic purposes, a work which has been completed by Captain Jack. I mention this because it is a piece of work for which this Society helped to supply the funds.

After the paper, Sir JAMES HAYES SADLER: I happened to be Commissioner in Uganda when Major Bright arrived to undertake the survey of the Anglo-German Boundary Commission under Colonel Delmé-Radcliffe, and I have had the pleasure of being acquainted with Major Bright for the last seven years. I am sure we are all much obliged to Major Bright for the admirable lecture which he has given us this evening. Not only have we seen most beautiful photographs of the very interesting expedition he conducted, but we have been given practically a life-history of many of those most interesting tribes with whom he came across, including that very jovial tribe which exchanges its young. I do not think really I can say anything of much interest with regard to the country on the boundary traversed by Major Bright, because I myself have only been as far as Katroe and the southern basis of the Ruwenzori mountains.

Sir HESKETH BELL: I am very happy to respond to your kind invitation to say a few words, inasmuch as it enables me to join in thanking Major Bright for his very interesting and instructive lecture. I happen to know a good deal of the country he has so admirably described to us, and can vouch for the accuracy of the very delightful water-colour drawings we have seen on the screen, and which, I believe, are the work of Captain Jack. I can also vouch for the great potential value of the districts he has described.

With characteristic modesty, Major Bright has omitted to tell us anything about the many difficulties of the Mission confided to him and his companions. I happen to know, however, that the situation was often difficult, and required careful and tactful treatment. The combined boundary commissions were working in territory

claimed by both sides. The natives, not knowing to which side they might belong, and probably fearing that they might be backing the "wrong horse," were afraid to show much sympathy for either one party or the other, and gave no more help than they were absolutely obliged to. The fact that for over eighteen months the work of the Commission was carried on without a single serious complication is ample proof of the tact and discretion with which Major Bright and his officers performed the duties entrusted to them.

Many of the audience are probably aware that a difficulty has arisen with regard to the settlement of the boundary between the Uganda Protectorate and the Belgian Congo. Under the original agreement, which was concluded at a time when the districts concerned were very little known, it was decided that the 30th meridian should be taken as the boundary. This decision was, of course, based on maps existing at the time. The line was not a good one, inasmuch as it cut off a considerable portion of the territory of a king who was under our protection; but it gradually became fairly well known, and the country right up to it has been for a number of years administered by British officers. I believe that to the Anglo-German Boundary Commission, which delimitated the line between Uganda and German East Africa in 1902, is due the credit of having discovered that the 30th meridian, instead of being where it was supposed to be, was really about 11 miles to the eastward of the old line. Upon this discovery being made known, the Belgian Government claimed all the intervening country, comprising a strip about 11 miles broad by about 150 miles in length. We could not agree to this claim, but it was agreed that, pending the exact location of the 30th meridian by a combined Boundary Commission, neither the Uganda Government nor the Congolese Government would exercise any active authority in the disputed zone. This has been a very unfortunate arrangement, inasmuch as the withdrawal of all European authority has thrown the district back into anarchy and barbarism. It has become a sort of negro "Alsatia," to which numbers of disaffected natives and criminals have resorted. The authority of the King of Toro, to whom the country properly belongs, is flouted, and a situation has been created which has a very evil effect on the neighbouring territories.

In most countries, and certainly in equatorial Africa, an arbitrary line, based on astronomical observations and having no regard to tribal divisions or other local interests, usually makes a most unsatisfactory boundary, and causes much injustice and hardship. A native cannot satisfactorily serve two masters any more than a white man can, and it follows that if the territory of a native king be arbitrarily divided between two different European powers, the unfortunate potentate in question is obliged to opt for either one side or the other, and will in most cases have to lose all that portion of his territory which does not fall within the sphere to which he has elected to belong. About three months ago I was again in the neighbourhood of the Congo border, and met a number of the chiefs whose districts and peoples will be greatly affected by the settlement of the boundary, and it was touching to see the extreme desire of all these people to remain British. During the past ten years they have looked upon us as their protectors, and to our officers for guidance and help in the improvement of their people. They have evidently learnt to associate British rule with justice and humanity, and it is earnestly to be hoped that, in the settlement of the boundary, some arrangement will be arrived at which will secure to the natives who have always been loyal to us the peace and protection which they so greatly desire.

Captain MERCIER, a member of the Belgian Commission, expressed his thanks for the kind invitation which had been sent to him to attend the meeting, and his high appreciation of Major Bright's lecture and of the beautiful slides which had

been thrown upon the screen. These recalled to him the cordial relations which existed between the Belgian and the British sections of the Commission. He spoke in appreciative terms of the high qualities displayed by Major Bright in directing the operations of the British section of the expedition; he also conveyed his thanks to the Governor of Uganda for the sympathetic reception he had received on his journey through Uganda.

Mr. Freshfield: Major Bright's notes on his most interesting journeys on the Anglo-Congolese frontier have brought back very vividly to my memory scenes which I saw four years ago. There are but few remarks that I can add that will be of any service. I would first say how much we have appreciated the photographs and also the drawings. It was quite evident from some of the photographs that whoever took them had been up to the very foot of the glaciers on the western side of the Ruwenzori range, and thus completed our knowledge of its central portion. There are two slight corrections which I may make. The mountain lakes are not in the snow region, but at the foot of the glaciers. They are in origin morainic lakes, and indicate a retreat of the ice. It was stated that a member of this party was the first European to *cross* the highest part of the range. The more accurate phrase would be "to make the first complete passage of the range from side to side." The Duke of the Abruzzi's expedition crossed in at least four places the highest portion of the water-parting. I may add that the peak in the centre of the woodcut on p. 256 of vol. 2 of Stanley's 'Darkest Africa,' corresponds unmistakably in outline with the "Mount Emin" of the Duke of the Abruzzi, and that Lieut. Stairs in reaching the foot of "The Twin Cones" must have gained the edge of, if he did not penetrate, the tract marked as "inaccessible country" on Major Bright's map.

Captain E. M. Jack: After the Commission work was finished, we measured a certain portion of the 30th arc of meridian. The 30° is that meridian which has its greatest length on dry land, and which therefore offers greater opportunities for measuring than any other. It extends from Southern Natal through Rhodesia and German East Africa, between the Congo Free State and Uganda, up through the Sudan and Egypt, across the Mediterranean into Russia. Triangulation has now been completed in Russia, Uganda, and from about 100 miles south of Lake Tanganyika (*i.e.* lat. 9½° S.) to the terminal station in Natal. In Egypt a primary triangulation is now being carried up the Nile valley. The only portions, therefore, which are not actually measured or started are those across the Mediterranean, in the Sudan and in German East Africa, and it is hoped that the latter will be undertaken before long.

We measured from 1° 10′ N. to 1° 10′ S.; that is, from the south end of Lake Albert down to German territory. Fourteen main stations were occupied, and one secondary one on Lake Albert, in order to connect with the known level of the latter. Besides this, connection was established with a point on the Uganda survey, and observations taken to peaks of Ruwenzori and other points. One base was measured, 16 kilometres (10½ miles) in length, in the Semliki valley. The two points observed at in German territory leave a very good base for carrying on the work southwards.

Mr. Wollaston: After the comments of the Governor of Uganda, there does not seem very much to say. I have listened to this paper with great interest and pleasure. As I was nearly a year on the slopes of Ruwenzori, I can to some extent appreciate the labours and the difficulties that have made this paper possible. When I saw these beautiful pictures on the screen, I fancied myself back in those familiar scenes. I could see the monkeys running about in the tree-tops, and with a slight effort of imagination, I could detect the characteristic odour of the Bakonjo porter. I think if the light had gone out in the hall, I might have heard the

hippoes grunting, and the murmur of mosquitoes. Major Bright is to be congratulated on the beautiful series of maps the expedition made, and I should like to add a word of thanks to him for a most delightful lecture.

Captain BEHRENS: I feel there are so many other distinguished people here to-night who have more to say on the subject really than I have, and to whom you would much rather listen, that I can only wish to add my hearty vote of thanks to Major Bright for his extremely interesting lecture, which represents so much hard work and difficulty in a most arduous country.

Mr. FISHER: I have to add my thanks to Major Bright for his most interesting lecture. I think it was in 1896 that I was first privileged to travel over the greater part of the journey he has taken us through to-night. I am glad to see the present Governor of Uganda, to whom we owe so much; you will find no country has developed so fast. Uganda, I think, is the only map in the whole world which becomes obsolete every three months. You will find the present governor has introduced a motor-cycle and motor-car; he has done a journey which twelve months ago took him from ten to twelve days, on a motor car in eleven and a half hours, having stopped for half an hour in the middle of the day. I love that big mountain Ruwenzori; I think it is the greatest geographical feature in the whole of Africa. I lived on the eastern slopes of Ruwenzori for five years, and every day I looked up in the direction of the snow-peaks, and I can confirm what Major Bright has said, that there are very few days when you can see the top of Ruwenzori, and I have no doubt that gave rise to the name by which these high peaks are known. I have seen electricity pouring into the mountain without cessation for I think ten to fifteen minutes, just before a terrible thunderstorm passed over the country, and day after day you see these wonderful effects, which are delightful.

Colonel CLOSE: No one can look on the map which has been distributed without partially realizing the immense amount of labour expended on the exploration of the region by Colonel Bright and Captains Jack and Prittie. The map is a detailed account of the region in question, and is something very different from what we are accustomed to see as the result of slapdash journeys in Africa. From this map a model has been constructed, and those who are interested in the exact representation of topographical features—features which only change in geological periods—should study this model, which is now on view in the tea-room.

The PRESIDENT: Unless any one else wishes to take part in this discussion, I will now bring it to a close. I do not propose to take any part in it myself, but I should like to endorse what Colonel Close has said, and to add that from even a casual inspection of this map, any one can see what an admirable bit of work has been done by our lecturer. I am certain it will remain as a practical memorial of Major Bright's visit to Africa for many a long year to come.

A NEW GEOGRAPHY.

By R. D. OLDHAM.

IN choosing the title of a "new" geography, I have intended to suggest, at the outset, that this paper deals with a subject which lies outside the limits of the "old" geography, or geography as generally understood at the present day, though I regard it as being properly geographical, in the truest sense of that word.

It is only of late years that the determination of what are to be regarded as the limits of geography has become a matter of importance; and some twenty years ago, when, with the revival of geographical study, geography ceased to be the mere list of names into which it had degenerated, Sir Clements Markham, then President of this Society, proposed that the limit between it and geology should be determined by the absence or existence of human records; that all which happened before should be relegated to geology, and all which happened after should belong to geography. This view was repeated a few years later, when he said that "the true distinction seems to be that the geographer contemplates the present in the light of changes that have taken place in the past, while the geologist studies the past in the light of the changes that are taking place in the present." * This, or some modification of it, seems to be a limitation acceptable to many geographers, and a reference to Dr. Herbertson's review † shows that nearly every suggested definition limits geography to the relation of man to the natural phenomena on the surface of the globe, or their reciprocal relation to man, and consequently excludes all that occurred previous to his appearance on the Earth.

Now, if geography were an art—and the thesis might be argued—this limitation would be natural and logical; but if geography is a science it is illogical and unworkable or, in a word, unscientific. Nor has it been adopted in practice by geographers, whatever their verbal professions may have been, and papers have been published in this *Journal* which no one can fail to recognize as geographical, though they would have been excluded by any enforcement of a time limit. In this respect all definitions of geography which have yet been proposed, seem unsatisfactory as introducing an artificial, unnecessary and unworkable limitation, and in their place I suggest that the truest and most workable definition of geography is indicated by the etymological meaning of the word, as the department of human knowledge, that is to say the science, which deals with the description or delineation of the Earth. This definition will at least give it natural and easily defended boundaries, and within his own territory and in the pursuit of his lawful activity, the geographer is as much entitled to make use of the fruits of cognate sciences as is the citizen of London to the bananas of Jamaica or the oranges of Spain.

There was, however, one restriction to which the old geography had to submit, not through any self-denying ordinance of geographers, but from the inherent limitation of human knowledge. It could concern itself only with the surface of the Earth, for whatever might be surmised, conjectured, or inferred, there was no possibility of knowing anything of

* *Geographical Journal*, October, 1904, vol. **24**. pp. 417–423.

† *Ibid.*, December, 1905, vol. **26**. p. 594.

what took place in the interior of the Earth, till the progress of the study of earthquakes enabled us to see—dimly and uncertainly at present, but indubitably with greater clearness as time goes on—into the interior of the Earth, and to arrive at some definite knowledge of its constitution; and so the new seismology has prepared the way for a new geography, which is concerned with the delineation of the interior of the Earth we live on.

Although we may all have a pretty fair general understanding of what the word "earthquake" means, when used in a popular sense, it is by no means easy to give a scientific definition which will be complete and satisfactory. To Robert Mallet and his school an earthquake was a wave or series of waves of elastic compression, propagated outwards from a definite centrum of comparatively small extent. This view is now more than old-fashioned, and the advance of knowledge has shown, not its inaccuracy, but its incompleteness; an earthquake is still recognized to be, so far as observable phenomena are concerned, very largely a form of wave motion, propagated outwards from an origin, travelling forwards with a speed which can be measured, and diminishing in intensity as it progresses; but this wave motion is not of the simple character once ascribed to it, rather it is of an extremely complicated nature whose true character is only approximately known.

This form of earthquake is at most a temporary disturbance, objects on the surface of the earth may be disturbed, buildings injured or destroyed, and the surface soil may be displaced, causing fissures to open in the ground and landslips to descend from the hills, but as regards the solid rock no change takes place, the earthquake passes as the waves that sweep across a field of corn, and all returns to its original condition. This form of disturbance hardly affects geography, apart from its effect on man, but there is another, which may lead to important geographical changes; in a small number of cases, perhaps a larger number than is at present supposed, but probably in not more than some sixty or so out of the 30,000 earthquakes which take place each year, there is a disturbance of a very different character, by which rocks are rent or bent and permanently displaced from their precedent position, and it is by this form of earthquake that the old seismology is in relation with the old geography. I propose therefore to devote a short time to this, as leading up to the principal object of this paper.

The most familiar effect is the production of what is geologically known as a fault—that is to say, a fissure, one side of which is upraised, with or without lateral shifting, relatively to the other side. This phenomenon was noticed in the Calabrian earthquake of 1783, and again in 1819, when the earthquake originating in the Run of Cutch gave rise to the "Allah Bund," and caused the submergence beneath the sea of 2000 square miles of land. The formation of an earthquake-fault

was described by Sir C. Lyell in connection with the New Zealand earthquake of 1855, many instances were recorded by Darwin in South America, but the most familiar one is that of the Japanese earthquake of October 28, 1891, for Prof. Burton's photograph of the Mino-Owari fault, produced by that earthquake, has become a stock illustration in geological text-books. This fault was traced by Prof. Koto, running straight across hill, valley, plain, and river, for a distance of over 40 miles, in some places hardly discernible except to the practised eye, in others marked by an abrupt scarp of as much as 20 feet in height, where one side had been uplifted. In the Indian earthquake of June 12, 1897, more than one such fault was observed, the greatest being traced for more than 12 miles before it got lost under the alluvial plain of Assam. In its course this fault crossed and recrossed repeatedly the beds of a small river and its tributary streams, and gave rise to a dozen sheets of water ranging in size from 100 yards or so across to a lake of over 1½ miles in length. At other places the stream found a sudden drop in its course, and waterfalls were formed where it crossed the fault from the upthrow side. Another phenomenon was noticed in this earthquake, namely, that even where there was no actual fracture and faulting at the surface there might be change of level in the shape of a tilting of the ground and uplift of one place relatively to another. In this way the aspect of the scenery was changed, places came into view which before were hidden by intervening hills, others became hidden which before were visible, the slopes of the river channels were interfered with, and many small pools and lakelets formed by reversal of the natural slope of the river channels. In 1906, again, it was found, after the earthquake which led to the destruction of San Francisco, that movement had taken place along a fault-line which could be traced for over 185 miles from San Juan to Point Arenas, where it passes under the waters of the Pacific ocean to continue a submarine course of unknown length. Along the whole of this distance it was found that the opposite sides had moved, sometimes vertically, but always horizontally, so that every fence, or road, or path was broken at the fault-line, and the ends offset, one from the other, by distances ranging up to 20 feet.

The distinction between these two forms of disturbance, the vibratory movement which passes away and the upheavals and displacements which remain, is so fundamental that it seems necessary to have different words to express the two concepts; and I have recently suggested * the word *orchesis*, meaning a rhythmic dance, for the vibratory movement, and *mochleusis*, derived from a Greek verb meaning to upheave or displace a very heavy weight, for the permanent displacements. Small earthquakes may very probably originate, as is often stated, in fracture of rocks which have been strained beyond their limit of endurance, and in them the disturbance, so far as we can observe it, is entirely vibratory,

* *Quart. Journ. Geol. Soc.*, vol. 65, 1909, p. 11.

but a detailed study of the permanent displacements, of such earthquakes as the Californian of 1906, or the Indian of 1897, has shown that this explanation is inadequate, and that in their case both mochleusis and orchesis are but the result of a great disturbance affecting not only a large area, but a considerable thickness—considerable, that is to say, in relation to the deepest of our borings, though possibly insignificant in relation to the diameter—of the Earth.

It is this greater depth of origin which appears to constitute the distinction between the local shock, which, however severe, does not affect distant instruments, and the great world-shaking earthquakes, and it is in the deep-seated disturbance, or *bathyseism*, that we must look for the origin of those waves which travel outwards in all directions through and around the Earth till they affect and are recorded by suitably constructed seismographs.

These instruments have been constructed in many different patterns, but all are designed to register one or other of two forms of disturbance. In some a heavy weight is suspended so that when the ground moves to and fro it will remain stationary, and by suitable arrangements the movement of the ground, whether horizontal or up and down, may be recorded. Other seismographs, again, are specially designed to register the tilting of the ground, but it is not possible to devise an instrument which will respond to one of these forms of disturbance and remain unaffected by the other; all that can be done is to contrive that they shall be affected as little as possible by one, and as much as possible by the other form of movement. As extreme types of instruments in common use, we may take on the one hand Prof. Wiechert's instrument, with a heavy mass of about a ton in weight poised on the top of an inverted pendulum, kept in position by steel springs, and controlled by an arrangement which makes it dead-beat, and allows the heavy mass to return to its original position, when displaced, without swinging beyond; and, on the other, Prof. Milne's instrument, where everything is made as light as possible, and every resistance to the free swing of the pendulum eliminated to the utmost degree. Intermediate between the two we may place the weighted free-swinging pendulum used in Japan and Italy, which loses some of the advantages of one extreme to acquire some of those of the other. Whatever type is adopted, the sensitiveness depends to a great extent on the care and skill with which the instrument is constructed, and some idea of the character of workmanship put into instruments in ordinary use may be gathered from the fact that Prof. Wiechert's instrument records horizontal displacements of as little as one fifty-thousandth inch, while Prof. Milne's easily registers a tilt of one-twentieth second of arc, or about the angle subtended by a penny piece at a distance of 80 miles. Even greater delicacy of adjustment is possible in either case, but ceases to be practical.

We will now consider what happens when the disturbance due to a great earthquake, originating at a distance somewhere between 2000 and 7000 miles, reaches one of these instruments. All, we will suppose, has been still; the paper has travelled steadily under the recording point—be this a spot of light, a pen filled with ink, or a needle-point, scratching on a piece of smoked paper. Presently the outrunners of the disturbance arrive, the so-called preliminary tremors, which cause the ground to move to and fro, but as this movement rarely exceeds one-hundredth inch, and takes from two to eight seconds to complete a to-and-fro movement, the tremors are unnoticed by men or animals, though not by the seismograph; this feels the motion, and the recording point, which had previously traced a straight line on the paper, begins to move to and fro. The form taken by the record depends in part on the disturbance itself, but more largely on the nature of the instrument; assuming that the disturbance is sufficiently great to give a perfect or approximately perfect record, and that the instrument is of the ordinary horizontal pendulum type, what happens is as follows. First, there is a small vibration of the recording point to and fro, which increases and decreases, but at from three to ten minutes after the commencement, according to distance from the origin, there is an abrupt increase in the range of motion, and the period of the to-and-fro movement becomes longer; this marks the commencement of what is known as the second phase of the disturbance, and the two together constitute the preliminary tremors. Then, after an interval which gets longer with the increase of distance from the origin, long slow oscillations of greater amplitude begin, which still later give way to somewhat quicker but much larger swings of the pendulum, after which the disturbance tails off. These larger oscillations constitute what is called the third phase, but by Japanese workers the principal portion, of the record; they are caused by a slow tilting of the instrument from side to side by long low undulations, from 25 to 50 miles in length, though only a few inches in height, which, like an ocean swell, travel along the surface of the Earth, and, because they are surface waves, can tell us nothing of the constitution of the interior of the Earth.

Not so the preliminary tremors. These, it is no longer possible to doubt, are propagated through the interior of the Earth, and as the rays of light impinging on the photographic plate give a record and picture of the object from which they came, so these earthquake-waves, travelling through the Earth and impinging on our seismographs, give a picture, dim and obscure, out of focus probably, under-exposed and fogged, but still a picture of some sort, of the internal constitution of our Earth. We have no direct knowledge of the nature of these earthquake-waves any more than we have direct knowledge of the nature of the waves of light; we have but a partial knowledge of the exact nature of the disturbance produced when the earthquake-waves emerge at the surface

of the Earth, but we have by this time acquired a pretty good knowledge of the time they take to reach various distances from the place where they originate, and hence of the rate at which they travel. But the rate at which wave-motion is propagated and travels through any medium depends on the physical characteristics of that medium, and therefore if this rate of travel is known we are in a position to draw conclusions regarding the nature of the material which is traversed by the waves in their progress from the origin of the earthquake to the observatory where they are recorded.

The determination of the rate of travel is not, however, easy or simple; no single observation, nor the records of a single earthquake, can be taken alone, and the only course admissible is to take an average of a large number of observations, but not an arithmetical mean. For reasons which it is unnecessary to detail here, this simple process would not give a satisfactory result, and, omitting the description of the process followed, it will be sufficient to give the result, which may conveniently be presented in a tabular form in which the figures represent the time-interval which is taken by the waves of the first and second phases in travelling from the origin of the earthquake to points at distances up to 120°, or about 8000 miles: *—

Distance in degrees of arc.	Interval in minutes of time for	
	First phase.	Second phase.
15	3¼	6½
30	5¾	11
45	8	15
60	10	18½
75	11¾	21¼
90	13½	23¾
105	15	26

The first and most obviously noticeable feature of this table is the great increase in the apparent rate of travel—measured along the surface of the Earth—as we recede from the origin of the earthquake. The first

* 15° of arc are approximately equivalent to 1000 miles, actually to about 1036 miles, on the surface of the Earth. I have throughout this paper taken the circumference of the globe as 24,000 miles and its diameter as 8000 miles. The latter of these figures is about 1 per cent., and the former about 3½ per cent., too small. As the uncertainty of the time interval is at least double the latter amount, it seemed that the great saving in calculation did not involve any real loss of accuracy. The intervals differ from those published in the *Quarterly Journal of the Geological Society*, vol. 62, p. 456. At the time when this earlier table was prepared the data were much more scanty than at present, and as the figures were required merely for comparison one with another it seemed safer to take the means of the observations. Those printed here may be taken as correct within a quarter of a minute; a greater difference than this in the case of any record is an abnormality which requires explanation.

preliminary tremors, for example, take about 3¼ minutes to reach a point 1000 miles away, or an average speed of about 300 miles a minute, while between two points 6000 and 7000 miles away the interval is only a minute and a half, giving an apparent speed of about 666 miles a minute. The meaning of this is that we are not dealing with waves which travel at a uniform, or nearly uniform, speed along the surface, but with wave motion which has taken a short cut through the interior of the Earth, and the next step is to calculate what the rate of travel would be if the wave-paths were straight lines through the interior of the Earth. This calculation gives the following result :—

Apparent Rate of Propagation along the Chord in Miles per Minute.

Distance	15°	30°	45°	60°	75°	90°	105°
First phase ...	321	360	383	400	414	419	423
Second phase ...	160	188	204	216	229	238	244

Here we have much greater uniformity, but still the time is not proportional to the distance, and the further we go the faster the rate of travel seems to be. This means that the deeper the waves penetrate below the surface the faster they travel, and it is a necessary conclusion from this that the wave-paths are not straight lines but curved; for it is a law of wave-motion of every kind that when it passes from one medium into another, in which its rate of travel is different, it is refracted—that is to say, the direction of travel undergoes a change. We are most familiar with refraction in the case of light—it makes possible the microscope and telescope, and the apparent bending of a stick, half in and half out of water, is due to the bending or refraction of the rays of light; but it may equally be observed in the waves of the sea. Often on a shelving beach one may observe waves in deep water travelling obliquely along the shore-line, and bending round gradually as they enter shallower water where their progress is slower, till finally they break nearly parallel to the shore; the change in the rate of travel has caused them to be refracted, and earthquake waves are affected by this law as much as the waves of light or of the sea.

Another point to be noticed is that there is no great or sudden break in the gradual increase of the apparent rate of travel; it is more rapid at first, and slower later on; but the change is continuous, and we may safely conclude that there is no abrupt or rapid change in the character of the material encountered by these waves in their course. Now the straight line joining one point on a circle to another at a distance of 105°, reaches a maximum distance of about four-tenths of the length of the radius from the circumference; but the earthquake wave-paths, as has been explained, are curved and reach to a greater depth than the chord, so we may conclude that, to a depth of from about one-half to three-fifths of the distance to the centre of the Earth, there is no great change in the constitution of the substance of which it is

composed. The earthquake waves of the preliminary tremors, both first and second phase, travel faster as they reach deeper, but this increase is no more than can reasonably be explained by the increase of pressure.

At distances greater than 105° the records become too scanty for any certain deductions to be made, because it happens that the positions of established seismological observatories and those of the origins of the great earthquakes of the last fifteen years—and we can go no further back—are such that records from greater distances than 100° are rare, till we reach a distance of 150° to 160° from the origin, and here we have a group of records from which we can estimate the interval taken by the first preliminary tremors in traversing the distance from the origin with a satisfactory degree of accuracy. These are South American observations of Asiatic earthquakes, and the records obtained in Japan and the Far East of South American earthquakes, and from them we find that the interval is about 19¾ minutes, which represents an apparent rate of travel of about 400 miles per minute, and so we find that the increase in the apparent rate of travel, which had been continuous up to a distance of 105° from the origin, is not maintained at greater distances, but drops to the rate observed at 60° from the origin. The position, therefore, is this: that waves of the first phase are about a minute and a half later than they would be if the increase in the rate of travel were maintained, while the second phase, which was well marked so long as the wave-path did not descend deeper than halfway to the centre of the Earth, can no longer be recognized with certainty when the wave-path reaches three-quarters of the distance from the surface to the centre of the Earth. There is only one conclusion possible, that in the centre of the Earth, extending certainly to not more than half and very likely not to more than four-tenths of the radius, there is material which behaves very differently from that which lies outside of it; in this central core the rate of travel of the first preliminary tremor is checked and reduced by about one-tenth, while the waves of the second phase are either stopped altogether or propagated but feebly, with their rate of travel reduced by one half.

The wave motion which constitutes the first preliminary tremor is universally regarded as being of the form known as condensational or longitudinal, in which the molecules move backwards and forwards in the direction of travel of the wave. It is this form of wave motion which gives rise to the impression of sound, it is a form of wave motion which can be transmitted by matter in all its forms, whether solid, liquid, or gaseous, and it is the form of wave motion which travels more rapidly than any other. The rate of travel of these waves increases with the elasticity of the medium, but an increase of density causes them to travel more slowly. Mathematicians have told us that certain peculiarities in the astronomical behaviour of the Earth could not be accounted for if the Earth were of uniform substance throughout, and that the central portions must have a greater density than the outer,

though they have not been able to determine precisely the rate of increase. On the other hand, temperature and pressure increase from the surface downwards, but while we are certain that pressure must go on increasing down to the centre of the Earth, we do not know that this is also true of temperature. We have, then, two factors at work; on the one hand, the increase in pressure and of temperature both lead to an increase of elasticity and so to a higher rate of travel of the wave motion, and on the other hand, the increasing density tends to reduce this rate. If, then, we had only the first phase waves to consider, we might suppose that at first the increase of elasticity outweighed that of the increase in density and led to an increase in the rate of travel, but that at greater depths the relative effect of these two causes was reversed and the rate of transmission began to decrease. This, however, would not account for the disappearance of the second phase waves, and another explanation must be sought for.

I have said nothing about the nature of the wave motion which constitutes the second phase of the preliminary tremors, nor shall I enter into this question in detail, because there are two rival explanations in the field, which have this in common, that in either case the wave motion is of a nature which could not be transmitted by a gas, and the conclusion is suggested that the centre of the Earth is filled with gas, like one of the pneumatic golf balls introduced at one time. This may seem a paradoxical conception, but it is by no means a new one, for just one hundred and fifteen years ago Benjamin Franklin pointed out that if temperature went on increasing towards the centre of the Earth it must ultimately become so great that all substances would be converted into gas, or as he called it—using the nomenclature of his age—air.* In recent years Prof. Arrhenius has revived this conception, which has been generally associated with his name, and concludes that towards the centre of the Earth the temperature is so high that no known body can remain either solid or liquid, but all must be converted into the gaseous state, so that, on this hypothesis, the world consists of an outer solid shell, filled with gaseous matter highly heated, greatly compressed, and consequently very dense.

The disappearance of the second-phase waves is in accord with this hypothesis—at first sight so startling—of a gaseous central core for the Earth, but we must not too hastily assume that this is the real explanation. Columbus, as we know, never realized the true nature of his discovery, and throughout his life held to an erroneous theory, whose consequences survive in geographical nomenclature, but none the less was he the discoverer of America; and similarly, though we may be wrong as to the real character of the land which we see looming in the distance, there can be little doubt of the reality

* *Trans. Amer. Phil. Soc.*, 3, 1793, pp. 1–5.

of our discovery, and as the firstfruits of the new geography we may recognize that underneath the outer skin—a few, probably not more than 3 to 5, miles thick—of hard and solid rock, which still retains much of the character which we may notice at the surface, there is what is commonly called the crust of some 20 to 30 miles in thickness, in which the rocks are still solid in effect, but exposed to great pressure, which will cause them to flow if room is made in any way. In this crust no caves or cavities can exist, nor can a stretching strain be set up. Below the crust again comes a shell extending downwards to quite half the radius, or a distance of over 2000 miles from the surface, composed of matter so highly heated and exposed to such immense pressure that it combines most of the contradictory properties which attach to solids and fluids, as we know them at the surface of the Earth; and inside the shell comes a central core of some kind of stuff differing from that which lies outside of it, though we cannot at present say, with even an approach to certainty, in what this difference consists.

If these results should appear but a meagre return for the labour they have cost, it must be remembered that they are but the fruit of the first voyage of discovery—a voyage which will certainly be followed up by many more, some following the same track and extending the discovery, others taking a different direction, finding fresh landing-places, and penetrating to the interior of that continent whose shores we have sighted if not touched. The problem of the constitution of our Earth, which has long attracted and eluded the direct attack of speculators and of calculators alike, seems at last in a fair way towards solution, yet we cannot hold that the labour has been wasted nor the toil in vain, the various attempts, repeated at intervals and in varying ways, have at least kept the problem alive, till, as has often happened, and will happen again, light has come from an unexpected quarter, and now that the barrier is breached the flood of knowledge will pour in with increasing speed.

THE UPPER KAFUE AND LUSENFWA RIVERS, NORTH-WEST RHODESIA.*

By J. M. MOUBRAY.

Nearly all the country drained by the upper Kafue and Lusenfwa rivers is situated at an elevation of from 3500 to 5000 feet, the only exception being some low country to the south-east, of which the Aluanu valley is part, through which the Lusenfwa river flows after falling from the tableland over the Machinga mountains. In this valley in

* Map, p. 240.

NATIVE CANOES AND HUT.

AWATWA VILLAGE.

places, at certain times of the year, the thermometer registers a temperature as high as 120° Fahr. in the shade; here, however, the physical features do much to account for the extreme heat, as the surface is only from 1000 to 1500 feet above sea-level and is surrounded by almost vertical walls, the escarpment having an average height of from 1500 to 2000 feet.

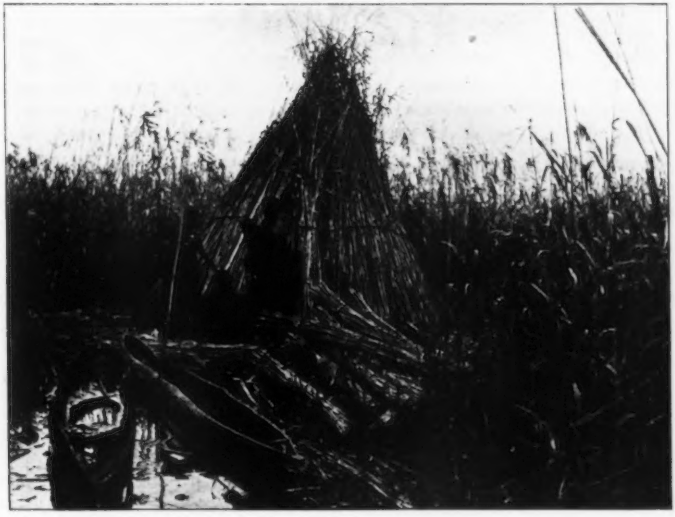
The Kafue river is one of the largest tributaries of the Zambezi, rising on the Congo Free State border and flowing for most of its course through a flat fertile country, in places thickly populated. Large quantities of game of all kinds are to be seen along its banks; but the upper part of the river is altogether in the tsetse fly area, so that no cattle can exist. The plains on either side of the lower reaches of the river are free from this pest, and large numbers of cattle are owned by the natives. Throughout its basin a number of hot springs occur; in one of these a small variety of fish is to be found living in water at a temperature of 135° Fahr. The vegetation is subtropical over that portion which is at the greater elevation, but in the "low country" tropical in the vicinity of rivers. The extreme heat only allows certain varieties of hard wood and thorn to survive where, through the dry season, there is not a continual supply of water.

Geologically the Kafue basin is old, the most recent beds of any size belonging to the coal-measures, and being situated a short distance northwards from the Sable Antelope mine. The area drained by the Lusenfwa is even older, much of the surface being made up of granites and the older metamorphic rocks. In the valleys to the south east are found many beds belonging to the coal-measures, but between these latter and the older limestones and phyllites there appears to be a considerable gap.

To the westwards of the present terminus—Broken Hill mine—of the Cape to Cairo railway is situated the Great Lukanga swamp which drains into the Kafue river. This swamp is inhabited by a people known as the Awatwa, who live almost entirely on the water. At many of the villages which I visited in the interior of the swamp the inhabitants informed me that they had not previously seen a white man, so a short account of a few of their customs may not be out of place. All communication is by boat along narrow channels made through the reeds, which grow to a height of many feet, and cover almost the whole surface of the swamp.

A village usually consists of some ten or more huts, but each hut is built on its own platform. These are constructed by throwing a number of bundles of reeds into the water till a platform some 12 feet or so in diameter, and sufficiently buoyant to support a hut and family, is obtained. On this the hut is built by placing a number of reeds and reed mats, with a few sticks, in conical form, and tying the structure together at the top. With the wet and dry season, as the water-level

AN AWATWA WATERWAY.



AWATWA HUT, SHOWING BUNDLES OF REEDS FROM WHICH THE PLATFORM IS MADE.

rises and falls in the swamp so does the hut. A small raised circular surface of mud is built in the centre of the hut, as without this protection the family fire, by which all the cooking is done, would soon burn through the floor. There is, as a rule, a space of open water in front of a village, and from this equivalent of our village green channels radiate to other parts of the swamp. Much of the food of the people consists of flour made from the sun-dried roots of a water-lily which is found in great abundance throughout the swamp; fish, chiefly of the barbel variety, is caught in great quantity.

Although mosquitoes of several varieties abound, the Awatwa appear to a great extent to be immune from malaria. When a death takes place, the body is disposed of by being placed on a small raft of reeds, and covered over by a mat of the same material; this strange craft is floated away far into the interior of the swamp and abandoned. Many of the natives find it hard to traverse any considerable distance on dry land, a possible explanation being that their feet have become soft through continual contact with the water, as most of the canoes are by no means watertight.

A considerable trade is done with the surrounding tribes who inhabit the mainland, these latter bringing grain, bark-cloth, etc., in exchange for fish.

The latitude and longitude of Bwana M'Kubwa mine, Broken Hill, and Silver King mine were fixed, the former by means of sextant and artificial horizon, and the latter by theodolite, and the position of a fixed point in the Machinga mountains obtained from the recent geodetic survey. A considerable part of the country in the vicinity of the Silver King mine having been triangulated, I obtained permission from the Northern Copper Company to make use of some of their figures. The remaining part of the map was filled in by prismatic traverses, plane-table work, and various small theodolite surveys.

The route followed by the railway was kindly supplied by that company, and I am indebted to Mr. J. E. Stephenson for much valuable assistance in the north-eastern portion of the country and along the border of the Congo Free State. There remains naturally much in the way of detail to be filled in, but the main river systems and mountain chains are shown, and perhaps one of the most interesting features in North-Western Rhodesia, after the Victoria falls—the Great Lukanga swamp, which is practically a shallow lake of very considerable size at an elevation of nearly 4000 feet above sea-level.

GHAT AND ITS SURROUNDINGS.*

By JAMY BEY, Governor of Ghat.

GHAT is situated in the valley of the Tenezuft, which has its source in the Tassili mountains, and, bending northward, loses itself in the Hamada to the south of the dunes known as Edeen.† It is said that when the rains are plentiful, the Tenezuft, after skirting the mountains of Tadrart and flooding the Hamada, throws itself into the Issuan, a tributary of the larger valley of the Igargaren. The name Okallon, generally given to the Tadrart mountains, really belongs to a certain peak which seems to block all the eastern horizon of Ghat. The watershed between the gulfs of Sidra and Gabes passes over these mountains.

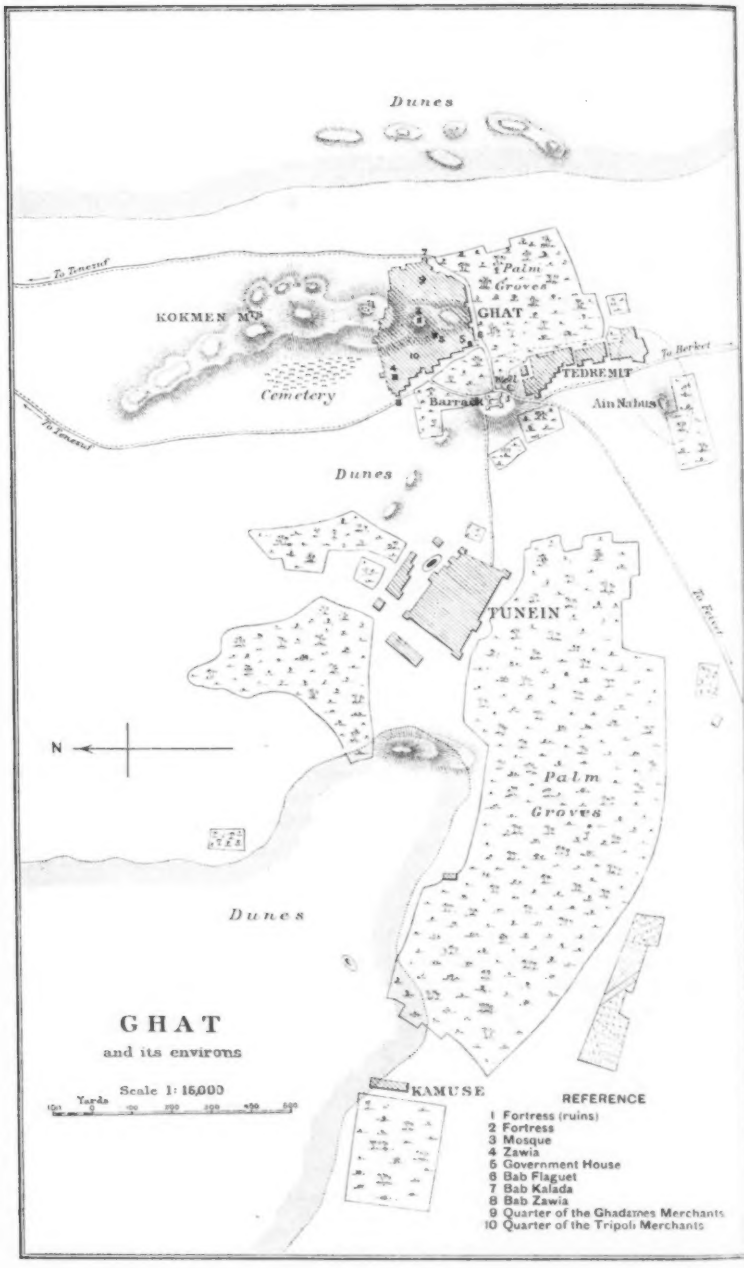
The Ghat of to-day is no longer the metropolis of commerce that it was in Roman times. The old Roman town was built some 7 miles to the south, close to the village of El Berket. No traces of Roman buildings remain, but some irrigation works and some terra-cotta vases found by workmen indicate the probable site of this celebrated town. The modern Ghat, with its two suburbs Tedremit and Tunein, lies south of the Kokmen hills, formed by three peaks which rise to 160 feet above the plain. In former times the frequent attacks of the Tuareg had obliged the sedentary population to take refuge on the precipitous southern peak, but when the inhabitants became more numerous, they were obliged to build a second fortress on a small rocky hillock below the first. This larger fortress, built of stone, is now the centre of the town of Ghat. A further increase in the population necessitated the building of new houses and ramparts. It is in this newer portion that the principal mosque stands, which leads one to believe that the central fortress was built before the time of the Arab dominion.

On the eastern side, on leaving the "new city" by the great gate, which still stands, you find yourself on the clayey plain, in the quarter inhabited by the traders of Ghadames. On the western side lies the quarter inhabited by the traders of Tripoli, in which the Zawiet of the Seussi was founded forty-five years ago. The enclosure which now surrounds the actual town has not been constructed expressly for purposes of defence, but is formed in great part by the exterior walls of the houses built side by side, all the small streets being also stopped up by walls. There are four principal gates, each protected by small towers and casemates. The caravans from Tripoli and the Sudan stop outside the largest gate, called the Bab-Tfaguet. A cattle market is also held there nearly every day.

Entering the town, one finds oneself in the market where Sudanese goods are sold by auction, and here traders from Ghadames and Tripoli can be seen sitting beside Tuareg and Ghatians. A little further on, a narrow street leads to the women's market, where they sell vegetables, eggs, etc. Except for a few old buildings, all the houses are built of dried mud, and the architecture is much the same as that found in all Moorish towns. On entering, one passes into a small corridor called salifa, which leads to an inner court, surrounded on three sides by rooms. The ceilings are made of the trunks and branches of trees, and the doors of rough planks of wild cypress wood, which is found in great quantities in one of the valleys of the Tassili near Janet. The heat during the day is unbearable, being thrown back from the walls of the narrow streets and from the sides of the Kokmen hills, which keep off all cool breezes from the south. At night the inhabitants take shelter in huts erected on the roofs, or sleep in the open courtyards; while, on cool summer

* Communicated by Mr. Hanns Vischer.

† *Edeen* is a Tuareg word meaning "dunes."


Dunes
To Tenemu
Palm Groves
KOKMEN MT.
GHAT
To Berket
TEDREMIT
Cemetery
Barracks
Ain Nahus
To Tenemu
Dunes
TUNEIN
To Berket
N
Palm Groves
Dunes
GHAT
and its environs
Scale 1: 16,000
Yards
KAMUSE
REFERENCE
1 Fortress (ruins)
2 Fortress
3 Mosque
4 Zawia
5 Government House
6 Bab Flaguet
7 Bab Kalada
8 Bab Zawia
9 Quarter of the Ghadames Merchants
10 Quarter of the Tripoli Merchants

mornings, many of the nobles gossip for hours beneath the shadow of the walls. The gardens of Ghat, watered by the large spring of Teheut, contain palm, orange, lemon, apple, apricot, peach, and pomegranate trees. There are also several wells whose water stands at 12 to 15 feet below the ground, and which are used to water the plantations of wheat, barley, millet, maize, and various vegetables, the water being drawn up by means of a pulley by one of the humped Sudanese cattle or a Janet donkey.

The suburb of Tedremit is a miserable village inhabited by a colony of Ataras, formerly the negro slaves of the Ghatians. The Tuat people live in the suburbs of Tunein, where the houses are better built than those of the town itself. There is a spring within the walls. The three principal springs are all of about the same temperature, from 100° to 104° Fahr. The population of Ghat, which numbers about 1300, consists mostly of Berbers who have immigrated from the extreme west of Africa. Only a few families are really Ghatians.

In summer the Ataras, like the Tuareg, wear a shirt, usually of white material, and over this a black or blue garment made of stuff from Kano. In winter they wear a burnus like the Tripoli people. They partially cover their faces like the Tuareg, and cover their heads completely before any noble lady. It is a fine sight to see one of the nobles of Ghat, draped in his ample garments, sauntering through the narrow streets, wearing great "balagas" on his feet, and carrying in his hand a fly-whisk made of a cow's tail. The women often wear the same shirts as the men, over which is draped the "abrok." Noble ladies wear a coloured "thrain," of Tuat manufacture. They keep their faces uncovered like the Tuareg.

The food of the Ghatians is boiled meat, with bread and dried vegetables. Like all the other tribes, they drink very sweet green tea after every meal. This tea is so precious that the key of the box in which it is kept is hung round the neck of the head of each family. Tyrannized over by their wives, the poor men have no liberty. This is by reason of the laws of inheritance (Tuareg and Ghatian alike), by which all the real estate is the property of the women. The husbands with a taste for dissipation are jealously watched in their movements by negress spies. Sometimes those who are late find themselves obliged to sleep outside the door.

The women in general go out only to attend weddings or the great fantasias of the "subaiba." They have one night of liberty a year, in order to go to the mosque and hear the praises of the prophet. The great fantasias take place during the national festival of the Ghatians, which commences on the 1st of every Moharem and finishes on the 10th. They are imitations of those of the Tuareg. In the centre of a great circle formed by the Atara women, the men perform a dance which consists merely of warlike marchings and counter-marchings, the women standing upright and accompanying the men with songs, clapping of hands, and swaying of their bodies; tambourine and flute players walk up and down inside the circle. The whole fantasia consists of the brandishing of weapons, marching, loading of arms, and taking aim. The women's dance called temeluket is very graceful, and is accompanied by songs. It is a kind of polka danced by two ladies, who show off all the graceful movements of their bodies, to which the white chemise clings tightly. It is only danced before women.

The fantasias and the subaiba make a pleasant break in the monotonous and dreary life of the Sahara between those two periods of the year, when the two caravans—from the north and from the south—meet at Ghat.

SOME OBSERVATIONS ON DEW-PONDS.*

By EDWARD A. MARTIN, F.G.S.

THE term "dew-pond" has been applied in the past to certain high-level ponds, the chief characteristic of which is that, as a general rule, they do not fail to give a supply of water when other ponds at lower levels have dried up. The source of the water by which the latter are supplied is apparent. They are fed in general by surface drainage, by brooks and ditches, or by the drainage from a road or high shelving ground around. The sources of supply in these cases are visible, and there is no mystery as to their origin or their replenishment. In the case, on the other hand, of ponds on high ground, where there are no brooks or ditches, and little, if any, drainage, certain of them have been found either never to have run dry within the memory of man, or only very occasionally. It has appeared, therefore, to those who have used such ponds, that there must be some means of replenishment which is not known in the case of ponds at lower levels, and, as there has been no visible source of replenishment at the higher levels which is not present at lower ones, it has been judged that moisture is received at the former in a mysterious invisible manner, and as the high grass ground around such ponds has been observed in the hottest weather to be thickly covered by dew after nightfall, it has been assumed, although not proved, that similarly the ponds received a deposit of dew, and so, with the customary habit of assuming where proof is absent, such ponds, about which the mystery hangs, have come to be termed dew-ponds. All ponds on high ground are not called dew-ponds, but there seems to be no agreement as to what constitutes a dew-pond, even between those who use the term for some ponds whilst denying the title to others.

Mr. Slade has endeavoured to show that there is no such thing as a dew-pond, but I think there are reasonable grounds for believing that certain high-level ponds do owe their maintenance to some other source than the rainfall, although the rainfall is a considerable factor in filling all ponds. The point we have to remember is that rain-fed ponds at low levels do run dry, as a rule, more rapidly than those on high ground, and this statement has been attested in the past by very many observers, from Gilbert White onward. If this were not a fact, we may assume that the term "dew-pond" would never have arisen, since, as I hold, it was invented to describe those ponds whose replenishment was a mystery, and for whose filling rainfall alone was seen to be insufficient. We start, then, with the postulate that certain high-level ponds maintain their supply in the driest, hottest weather, long after those in the plains below have more or less completely dried up.

It seems to be generally acknowledged by farmers on and near the Sussex downs that the word "dew" must be held to include mist and fog, and the word "mist-pond" is, as a matter of fact, more in constant use in some parts than the word "dew-pond." Any inquiry into the source of the supply must therefore, I think, comprise in its scope the possibility of both dew and fog being deposited on the surface of a pond. One sees occasionally on a damp morning, or sometimes even late in the day, a deposit of water on the walls of a house, inside as well as outside: the walls "sweat," as it is called. There has been no fog, and one cannot call it dew. It is condensation out of the atmosphere, perhaps taking the form it does because of a lack of dust-particles in the atmosphere for the vapour to settle upon. Similarly we must consider the possibility of a condensation of this nature in a pond. Such might happen when a moving mass of heated and saturated air came in contact with a cooler water surface. Again, on many a damp morning, but with no fog, tall trees

* Research Department, April 22, 1909.

will be heard dripping their burden of aqueous condensation on to the road or paths beneath. This cannot be termed dew, properly speaking, although frequently referred to as such. So the fall of condensed vapour of this nature from vegetation must come within the scope of an inquiry into the subject of "dew-ponds."

The "dew," therefore, which goes to fill our dew-ponds must be regarded as including mist or fog and any possible form of condensation out of the atmosphere other than rain. Dew-ponds are always found on high ground. The question arises as to whether the maintenance of their supply is due to this position, or whether there is something in the manner of their construction which encourages an extra amount of precipitation over them. First, as to their position: this is usually the highest ground in the neighbourhood, sometimes at the very summit of the downs, and in Sussex, at any rate, without a single tree near which could in any way influence the deposition of moisture. In Berkshire and Surrey there is frequently a large overhanging tree. Wherever dew-ponds are found, it is a necessity, as most of the evidence goes to show, that they should either be upon chalk, or, if the subsoil is not chalk, a chalk foundation must be laid down. This would seem to show that chalk is a factor in the matter.

The lower temperature found at higher levels may cause a greater precipitation, as dew or mist. Temperatures taken by Mr. Sidney Skinner in proceeding to the top of St. Boniface down (787 feet) showed a reduction as follows:—

	Bottom.	Top.	Diff.
December 26, 1907 ...	42° F.	36° 8 F	5°·2 F.
„ 28, „ ...	37° F.	32° 2 F.	4°·8 F.
„ 29, „ ...	38°·3 F.	33°·5 F.	4°·8 F.

With the aid of a Royal Society Government grant, I have lately had under my special observation a tract of downland in Sussex, bounded on the north by the escarpment of the South downs from the Devil's dyke to Plumpton, and in this area are included some excellent ponds. My headquarters have been one of the disused mills on the Clayton downs, close to whose base is the Ordnance Survey bench-mark of 581 feet. A long spell of dry weather happened while I was there, and, being on the spot from dewy eve till early morn, I was able to make some useful and interesting observations. There are many downland ponds in the area to which I have referred; but two ponds stand out conspicuously amongst the rest as excellent examples of dew-ponds. The first is one which stands high up above the waterworks in the Waterhall valley, near Patcham, and is about 700 feet above sea-level. When I last visited it, on September 13 of last year, the water-edge had a circumference of 260 feet. Between the edge of the water and the top of the ridge surrounding it, there was a shelving bank, measuring 15 feet across, the ridge itself being 347½ feet round. The centre had a quantity of green growth below the surface on the eastern side, the place of this being taken by *potamogeton* on the western side; but in neither case did this approach to within 3 feet of the edge of the pond, nor did it grow above the surface of the water. All around this centre of green was a band of this width of clean white chalky puddle with no dark impurity at all. Around the edge of the water there was, on the northern side, a peculiar little ridge, like cliffs in miniature, marking the boundary of the pond. On the shelving bank thistles and hawkweeds and other plants were growing, and the pond would not appear to have exceeded for a long time its present limits. The pond is but slightly below the summit of the down, and had no drainage except such as it received from the banks. The second

dew-pond I specially refer to is near High Park Corner, 700 feet above sea-level, on the road between Ditchling Bostel and Brighton. On August 12 it measured 227½ feet around its edge, and between the edge and the top of the ridge there was a gradually shelving bank, 20 feet across. This, of course, gave a considerable collecting-ground, but with this exception there was no drainage whatever. A few yards away a large pit has been excavated to a depth considerably below the level of the water, and if the bottom of the pond were not completely watertight, the water would rapidly drain away. There is but little weed in the pond. The water is clear, and the puddle is a chalky white, hardening completely where exposed to the sun. On August 12, at 1 p.m., the temperature at 1 inch was 72°; but at 12 inches it was 67°, or 5° less. The sun was beating down strongly at the time. I could gain no information as to where any of the ponds about here were made, and therefore no information as to the manner of their formation. There is some clay in large pockets in the chalk near at hand; but, so far as could be seen, no clay had been used. A little distance below the highest ground is another pond, which, I was informed, had been repaired about fifty years ago, and the clay had been carted there for the foundations. Most of the ponds are, in general, clay-puddled, the ponds being more easily rendered waterproof by this means.

Scattered along the downs are numerous depressions which appear once to have been ponds, but neglect has caused them to leak and run dry. The life of down-land ponds is so long that they seem almost to be perennial. Hence, when once a pond has been successfully made, and it passes in turn into the hands of successive farmers, records of its making are lost, and, in view of its apparent perennial nature, it comes to be neglected. Then, when finally it ceases to be waterproof, generally by grasses and rushes growing their roots through the puddle, it gradually dries up, and then, the secret of its formation not being remembered, it soon reaches the stage of becoming covered with down-land grass, and an empty hollow alone remains. So little is done to most ponds nowadays in the direction of repairs that it is scarcely to be wondered at that so many empty pond sites are seen.

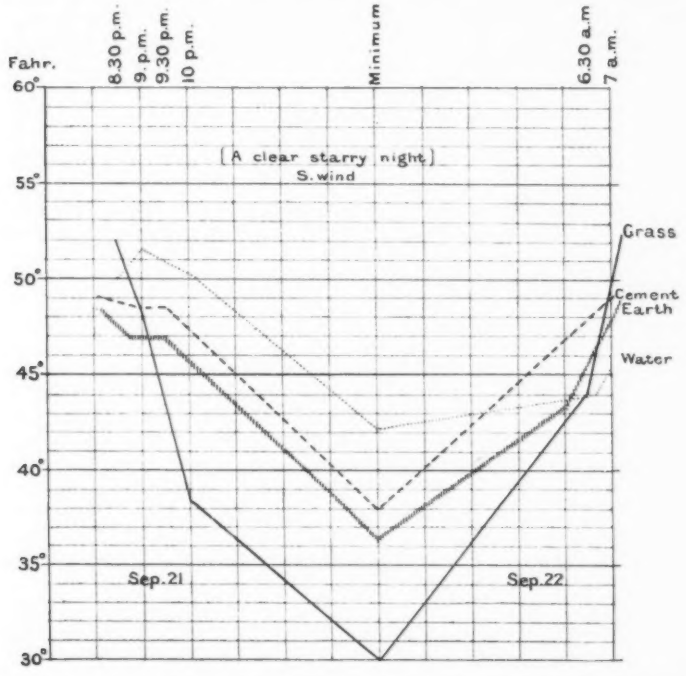
As regards those that still hold water, there is little unanimity as to which are and which are not dew-ponds. And when one who has known such ponds all his life is asked why one is called dew-pond and one is not, he can give you no clear answer. We must, therefore, find an answer for ourselves.

All ponds receive a quantity of rain; but to be a dew-pond it must by some reason or other attract dew from the atmosphere, deposited either upon its shelving banks or upon the water itself, or it must receive and arrest thick banks of mist, fog, or cloud, and assimilate the moisture. The shelving bank must in any case be a considerable factor in the matter, as I have poured water on the banks of well-puddled ponds and have found that the water had run down to the pond with no apparent percolation into the bank. For dew to be deposited on the surface of water it is generally considered that the temperature of the water must be below dew-point. We can leave aside the question of dew in the winter and spring months. The ponds to be useful must be receiving dew in the hot summer months, when drought may be prevalent, and when ponds on lower grounds are drying up. Ponds exceeding 4 feet in depth are rare, so that we have these ponds in shallow basins of perhaps 30 to 70 feet across, and the broad surface is being heated all day long by the sun. Water takes much longer than the soil or the atmosphere to become heated, but when heated it retains its heat correspondingly longer, and this is the greater the greater the depth of the pond. The accompanying diagram (p. 177) shows how that whereas the temperature on the grass went down from 52° F.* to 30°

* In each case Fahrenheit scale has been used.

on the night of September 21, that on the surface of the water in my experimental pond sank merely from 50° to 42°·5. Dew was forming on the grass at 9 p.m., the dew-point for the night being 45°·5, as determined by the wet- and dry-bulb thermometers. Of course it does not follow that when dew-point was reached on the grass the pond-water commenced to receive dew. The deposition of dew would be at first upon the most powerful radiators of heat, and amongst these grass stands high. Water is a very bad radiator, and would be the last to receive dew, if the acquisition of dew on its surface were merely the result of radiation of its own heat and the chilling of the air above it by contact with the cooled water surface.

The water on this occasion cooled down to below dew-point, and soon after 10 p.m. should, according to current theory, have commenced to receive dew. It



will be seen that the water (rain-water received during the few days since the completion of the pond) had already, at 8.30 p.m., reached a comparatively low temperature. This may be attributed to the fact that there were but 3 or 4 inches of water, and to the construction of its bed. It has been stated by Prof. Miall that a dew-pond must not be greater than about 4 feet in depth, this being about the depth which will allow the water to cool as a whole during the course of a summer's night. If it be greater, then evaporation will proceed until about that depth has been reached. If my pond remains sufficiently full in the summer to enable temperatures to be taken at 6 inches and 12 inches, or deeper, then it will be seen whether the pond, as a whole, reaches night after night a temperature which is below the dew-point. The grass around will be the first to receive dew, and the

period of dew-deposit will be much longer there than in such a pond, since even supposing a large pond does, as a whole, actually reach a temperature below the dew-point, this will only take place late at night or in early morning. In the morning, when the sun has risen, the warm air from the down will, I think, not soon interfere with the cold heavy air in the depression of the pond, and so the water will but slowly be warmed. A great deal depends on whether large ponds do actually, as a whole, reach a low temperature at night. If they do, and a fog be drifting in from the sea in the early morning, that portion which drifts into the depression will be further chilled, and may deposit its moisture. On the other hand, mist may merely be deposited in the pond mechanically as it passes over.

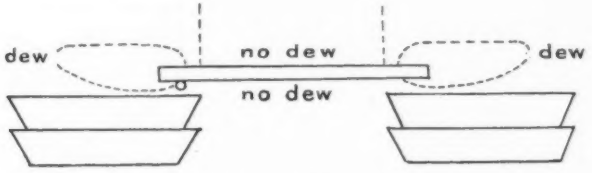
There was a long fogless period in August and part of September, and this may have accounted for the drying up of the pond called One Tree pond. On July 25 there were but 9 inches of water, although the circumference of the pond was 102 feet. Owing to the shallowness it became rapidly heated each sunny day. The temperatures at 1 inch, 6 inches, and 9 inches were all 71° at 1.30 p.m., that on the bank exposed to a south-west wind being 67°. The pond, as a whole, had become heated to this temperature, and evaporation was proceeding. On July 24, at 8.20 p.m., the temperature at the same three depths was 67°·5, the cooling to this slight extent in the shallow basin having apparently been uniform. The temperature on the bank was at the same time 58°·5, this again showing the less rapid cooling of the water than on the dry bank. A shallow pond seems to have no chance whatever in hot, settled weather, since the evaporation of the day would be continued well into the night, and possibly throughout it. On July 28, at 8.30 p.m., the thermometer at 1 inch showed 64°, and at 6 inches 63°·5. These temperatures were soon reversed, and at 9.10 p.m., whereas 1 inch showed 62°, 6 inches showed 63°. Then, at 9.50 p.m., both showed 61°. On each occasion the temperature of the air immediately above the water, as shown on floating cork, the bulb overhanging the water, was less than the 1-inch water temperature. At 8.30 p.m. it was 57°·5, and at 9.50 p.m. it was 55°. The dew-point some distance away was 50°·8, but the wind was too high for dew-deposition. It will thus be observed that the atmosphere was on each occasion colder than the water, and hence there would be no possibility of the water chilling the air sufficient to compel the latter to disgorge its aqueous vapour. If vapour were actually given up by the air there must have been some other cause for it. The rain came on at 10 p.m. Had it proved a clear, starry night the atmosphere over the pond might have become still further reduced, but the pond would have lost its heat still more slowly, and the difference between the two would have become accentuated.

The effect of radiation of heat from a pond upon the air above it must be regarded, I think, in a different light to the effects of radiation of heat from the earth's surface, *e.g.* the down-land. In the latter case, the heat rises with vapour out of the interstices of the soil, and is dissipated into space. The soil being cooled, brings about the cooling of the stratum of air in contact with it. When the cooling reaches the dew-point, the best radiators receive a deposit of dew. But as regards radiation from the surface of the pond, we have seen that the surface temperature is such that it can seldom have effect in cooling the air above it, since the air is already at a lower temperature. The cooling of the air must have been due to other causes, and I doubt if equilibrium between the two is ever obtained. Take one of the cases mentioned. At 9.50 p.m. the water was, everywhere in the pond, at 61°. The air immediately above it was 56°. The water was no doubt losing heat, but the air was losing it more rapidly, and the temperature of the air would easily fall below dew-point some hours before that of the water did the same. In that case, the point of saturation being reached, the stratum of air must give out some of its moisture, and

this would be rapidly assimilated into the pond. If evaporation of the pond were proceeding at the same time, this would tend to cause the point of saturation of the air to be reached the earlier. So I am inclined to think that dew may be received by a pond on its surface even while the pond-water itself has not yet fallen to dew-point. On the other hand, if it can only receive dew by chilling, as it is often said to do, the air above it, I cannot see how pond-water can ever reach a temperature at night-time lower than in the air above it, which would be necessary, if there is anything in this alleged chilling, so long as there is no change in the weather. It could only happen after some hours of freest radiation, and by this time probably the early sun will have begun to warm the air, the effect of this being to increase the amount of vapour which the atmosphere could hold without being saturated, and hence removing all possibility of precipitation. Even at 8 a.m. on August 9 the air at the surface of the water was but 58°, whilst 1 inch under the surface it was 60°. This was in light fog blowing from south.

It is not, perhaps, very important as to whether the dew "falls," as Dr. Wells demonstrated in 1814, or whether it rises, as has since been shown by Edward Blythe, and later by Dr. Aitken. Both theories have been maintained in turn by various meteorologists. It is, however, very easily demonstrated that both are correct. Two illustrations will suffice. On the night of August 13, two opaline saucers were placed on the grass. On one was placed a portion of cotton-wool. The other saucer was inverted, and a portion of cotton-wool placed beneath it.

The former portion was covered when examined the following morning with medium-sized beads of dew, the latter was dry. The dew, therefore, fell in this case. Again, a thermometer with a broad opal scale was supported between two double earthenware pans.



Where protected from the rising heat of the earth, *i.e.* over the pans, there were large beads of dew both on and under the opal scale, but the centre portion of the opal was dry top and bottom (as shown in the diagram). There was a clear line of demarcation. Here again the dew apparently "fell."

But on October 30, 1907, I placed two square polished tins to catch and condense the vapour radiated from the earth. One was inverted. In both cases no dew was found on the uppermost sides of the tins in the morning, whilst in both

cases the undersides were well covered with dew. Here, therefore, the dew rose from the earth after nightfall. Thus, on different nights it is not difficult to prove that both theories may be correct.

It must be confessed, however, that out of the numerous occasions on which I placed articles out at night to detect the dew, by far the majority received dew on the uppermost side, and so the older-fashioned theory of the two was well sustained.

And it is well for dew-ponds that it was so. If the ponds were recruited from dew only which rose as vapour from itself, it would gain nothing, whereas it would lose by evaporation which proceeded in the day-time, and the balance would be on the wrong side.

To sum up so far, the pond must not be too shallow, or it will become heated as a whole during a summer's day, and evaporation will proceed both day and night. It must be recruited principally by "falling" dew, but the temperature of the water need not, it would seem, be below the dew-point to receive it. In addition it may be stated that a gentle movement of the air over a pond would be beneficial, to waft away that portion which had given out its dew, and which consequently would have become warmed in the giving out of latent heat by the vapour contained in it.

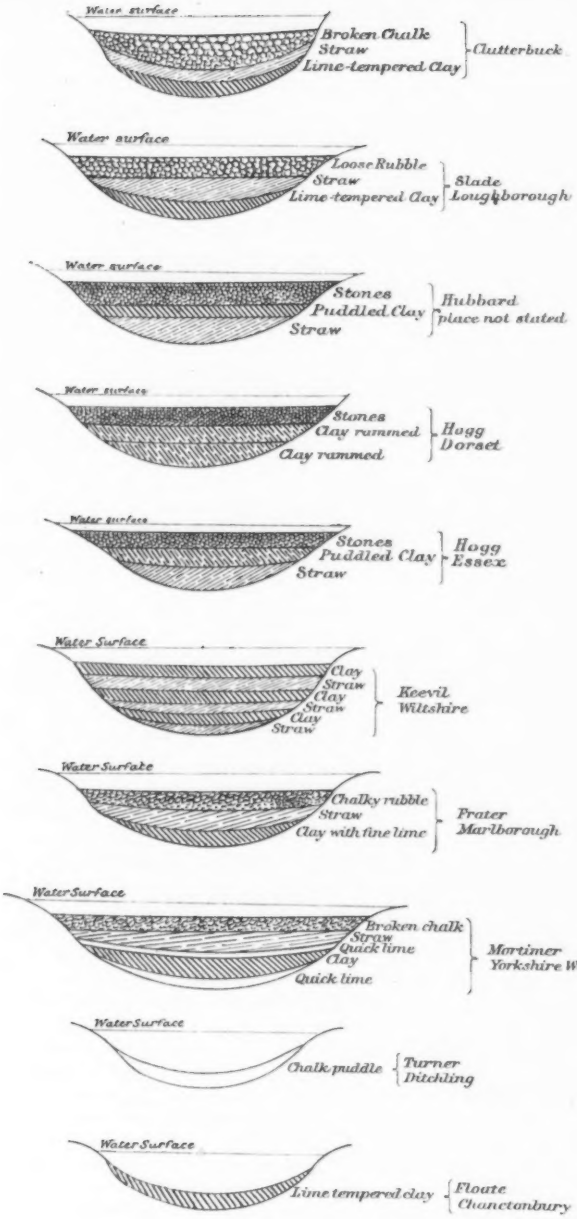
As regards the construction of a dew-pond, the theory has been advanced that straw is placed in some part of the foundations with the direct object of cutting off the upward rise of heat from the earth, and so allowing the water to become more rapidly cooled. This, of course, assumes that it is necessary for water to cool below dew-point before it can receive any accession. There is no doubt that straw frequently does enter into the formation of a pond's foundations, and probably a low temperature in the water is a desirable object to aim at. This being so, it seems reasonable to imitate the process by which ice is obtained in India at night-time, while the temperature of the air above it may be a good deal above 32°. Shallow earthenware pans, with water contained in them, are placed over about a foot of straw, and the straw prevents, by reason of its non-conductivity, the earth's heat from rising and warming the water, whilst the heat of the water is lost by radiation. Thus, although the temperature is above 32°, films of ice appear in the pans. Dr. Wells repeated these experiments, and added another, for in one of the pans which he left empty at nightfall, he found moisture had been attracted, and this had been converted into a film of ice.

Although I have found that straw is used in various places in the foundations of dew-ponds, not one of the builders of such ponds seems to hold that the straw has anything whatever to do with the filling of the ponds. The opposite diagrams will show the foundations as laid according to various authorities.

It will thus be seen that, in a majority of the cases quoted, straw is used in one position or another, whilst its utility as a dew-producer is, as a rule, denied.

It seems to me as possible that the memory of the reason why straw is used has been lost in the course of generations, owing to the serviceable age of such ponds, but that the practice has continued in spite of this lack of "folk-memory."

In the majority of instances shown, chalk rubble is used as the topmost layer, to prevent the perforation of the puddled clay by the hoofs of animals. In Sussex I have examined a number of downland ponds, and do not find this to have been the case. It is true that small chalk is now strewn over the bottom of a pond when repairs are undertaken, but this is only preliminary to the grinding of it to powder and to the puddling which follows, by driving a team of oxen or horses harnessed to a broad-wheeled waggon, repeatedly round and round, and through the pond, for at least a whole day. This process grinds the chalk to a powder, and lays it down as a waterproof puddle, and when there is no clay near at hand it is, of course, far more economical than carting clay to the site. When there is clay at hand, clay



Vertical thicknesses exaggerated.

SPECIMENS OF DEW PONDS.

undoubtedly is used, as being more reliable as an impervious bottom. Mr. Wooller, of Clayton, who went to live at the top of Clayton Downs in 1875, informed me that when a boy, he knew a pond which sometimes held a little water in it. When it had some water he obtained permission to drive his horses into it to clean their hoofs on his way home. After having done this repeatedly the pond began to hold more water. In fact, he had involuntarily puddled it, and the pond ceased to leak. In these cases there was, at any rate, no fear that the cattle would perforate the bottom. He also says that when a pond on Dale Hill was getting low his master used to set him to drive the oxen round and round the pond. He got very tired of his job, not seeing any reason for it, but it was no doubt with the object of well puddling the bottom, and so making it waterproof.

When this process has been completed, and the cattle or the broad-wheeled cart have done their work, men would take broad spades and flatten down the surface or smooth out the puddle until it was smooth as glass, but the centre was not generally touched, and if there were weeds and grasses growing there these were left, unless it was thought that their roots had gone too far down. The puddle on the banks of the pond, which increased in area as the water diminished in area during drought, set as hard as cement. The absence, then, of rubble, and the use of oxen, etc., for puddling, make me doubt whether the Southdown ponds have straw, at any rate immediately under the puddle. I am referring, of course, to those ponds in which one can see that chalk puddle and not clay puddle has been used. Mr. Turner, of Ditchling, who is familiar with the ponds on the hills of his neighbourhood, has never heard of straw having been used in any of them. On the other hand, no one hereabouts seems to know of any ponds having actually been made within recent years.

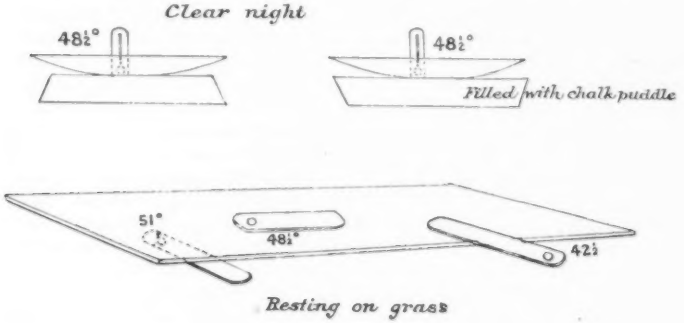
There seems to be a general agreement that lime should be mixed with clay-puddle to prevent the working of worms. It is a question whether earth-worms could be a danger under a pond, but there is the little red-worm, which must be guarded against. I am not familiar with many clay-puddled ponds, but there are two over Pyecombe, which I have examined, in which not a vestige of chalk or white puddle can be seen. One is excavated on a steep slope, so that one bank is very much higher than the other. On the side nearest the lower bank I was struck, on approaching it, by the red colour of the ooze where it was just covered by the water. Immediately I touched it, in order to take up a handful of the muck, the colour suddenly disappeared, only to reappear in a few seconds. On repeating it, I saw that the colour was caused by thousands of little red worms, and these, on the slightest movement reaching them, disappeared as if by magic. I think that the working of these red-worms would be a thing to guard against, in the case of ponds bottomed with clay puddle. I have kept some of these worms in captivity, so to speak, and find that, when the mud is sufficiently tenacious, they not only honeycomb it with their borings, but form tubes of mud, which may project as much as a quarter of an inch from its surface. When in the water, they travel far and wide by rapidly-made twists and jerks, looping themselves like the letter S, until they find a suitable lodgment. The pond I refer to received very much drainage, and could not be regarded as a dew-pond. The second clay-puddle pond was about a mile further north, and contained clearer water, although it was also on the slope of the hill, but there was a gorse bush growing down to the water's edge, whilst on the opposite side there was, close to it, the hedge which formed the boundary of the field, with a few fair-sized trees in it, and these, no doubt, gave a good deal of water to the pond by means of high-formed dew and the moisture from the mists. There was also a considerable quantity of drainage from one side of the pond.

These two ponds, although not dew-ponds, bear upon the subject, and may thus serve to throw light upon their replenishment.

It has been estimated that the average annual dew-fall does not exceed 1·5 inch. This, of course, is founded on the amount of dew which is deposited upon surfaces other than water. If dew is deposited on water in the manner which I have suggested, this estimate may there be exceeded. A heavy deposit occurred on the night of September 15. The night was clear, and the moon was bright. I had excavated a trough about 4 feet deep, and had placed a quantity of wood-wool over an area 6 feet square at the bottom, and this was covered by planks of wood. In order to keep it dry, and anticipating a dewy night, I spread over the whole a piece of waterproof sheeting 6 feet square. In the morning I poured the dew from it into the rain-measure, and found that it showed 1·31 inch. Spread over the whole area of 36 square feet, this would be a deposit of about $\frac{1}{200}$ inch (0·00496 inch). If this amount of dew fell each night throughout the year, we should have a total annual dewfall of 1·8104 inch; but I do not think it would be right to regard this one night's dew as a fair average. Probably not more than three times the amount would be deposited in any one week, and, estimated on these lines, the annual dew-fall would be 0·77376 inch, or somewhat over three-quarters of an inch.

I have elsewhere made the suggestion that if we seek a non-conducting material for the bottom of the pond, which shall at the same time be comparatively inexpensive, we shall find it in logs or planks of wood. Vegetation of all kinds is, of course, an excellent radiator and non-conductor, and when we see the bushes and grass covered with a deposit of hoar-frost, we can also notice how thickly the frost stands upon the wood of a fence. Evidence of its non-conducting property is also seen, as Mr. Hubbard has suggested, in the appearance presented by the ballast over the sleepers of a railway line, where frost will remain after it has disappeared from the material which is not underlain by wooden sleepers. Gilbert White mentions the fact that on a winter's morning trees have been discovered in the bogs, since the hoar-frost has lain longer over the space where they are concealed than in the surrounding morass. He suggests that old obliterated drains might by this means be discovered, as well as relics of Roman stations and camps.

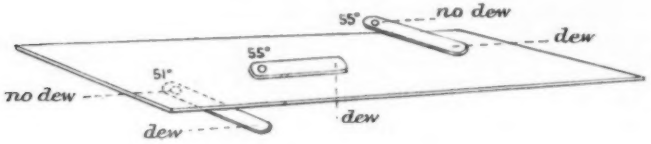
In order to test the extent to which the temperature was affected above and below wood resting on the downland, I placed two thermometers on a plank which



rested on the grass of the downland, and one underneath the plank (August 16). Next morning the one beneath showed that a minimum of 51° had been reached. One that was placed completely over the wood went down to 48°·5. The third was

placed so that the bulb and half of the tube was resting over the grass. This went down to 42°·5. Thus, although the temperature over the plank was higher than over grass, it was yet 2½° below the temperature beneath the board. The night was a clear one. On the same night the minimum temperature of 48°·5 was reached also in the following instances: in an opaline saucer, lying over a small red earthenware pan, and in a similar saucer over a tray containing chalk puddle.

Similar results were obtained on the night of September 11, when the thermometers were respectively 42°·5, 37°, and 38°, with heavy dew everywhere, and on September 12, when similarly placed, they showed 41°·5, 38°, and 38° respectively, and on September 8, where they showed 49°, 41°, and 42°·5. On another occasion (August 21) I placed two thermometers as follows: one beneath the wood, which



Resting on grass

showed a minimum of 51°; another resting completely on the wood, which showed 55°; a third resting with its bulb and a portion of the tube over the grass, with the remaining portion on the wood. In the morning the latter two showed a temperature of 55°, a higher temperature than the first mentioned; thus the relative temperatures were reversed when compared with the results of the night of August 16. The night was, however, a very cloudy night, and the deposition of dew at all was somewhat remarkable. There was no dew on the opal scale of the thermometer beneath the wood, but there were large beads on that portion which projected. The second thermometer was covered with large beads. The third had no dew at all where it overhung the grass, but where it rested on wood there were large beads in the morning. Thus, though it was a night when but little dew, if any, might be expected, yet the wood had so lowered the temperature of the air above it, by cutting off the earth's heat, that dew was deposited.

In regard to the question as to how far fog or mist goes towards replenishing ponds, it is well to bear in mind that the term "mist-pond" has been found in use in the neighbourhood of Worms Heath, in Surrey, in Kent, and in Wiltshire, as recorded by Messrs. Johnson and Wright. Mr. Johnson also records, in his 'Folk-Memory,' on Mr. T. W. Shore's authority, that the term "cloud-ponds" is used in some parts of Hampshire. I am also informed that some of the older inhabitants of Hampstead knew certain ponds on the heath by the name of "fog-ponds." If we give credence to the belief that dew is deposited in ponds, because people have come to call certain ponds by the name of "dew-ponds," then, it would appear, we have just as good evidence, if such it can be called, that certain ponds are recruited from fog, mist, and cloud; perhaps, indeed, better evidence. Every one acquainted with the Sussex downs must be familiar with the sea-fogs, which sweep inland from the south. One's clothing quickly becomes covered with a deposit of dew-like beads, and it seems to me that the warmth of pond-water will in no way act against the deposition of mist. The clump of trees surmounting Chanctonbury Ring is frequently completely hidden by its mist-cap. Sometimes, long after the mist has disappeared, not only in the weald below, but from the downs in the immediate vicinity, the whole area reeks with moisture.

It is noteworthy that the mists are generally on the move, although I have not yet seen them being driven northward of the downs in the shape of clouds. Fresh condensations of moisture seem to frequently appear, only to become dissipated in the warmer atmosphere, not many score of feet down the northern escarpment.

I am informed that on some of the downs in West Sussex the highest parts are chosen now for pond-construction, as being more exposed to the south-west moisture-laden winds. Dew would not be deposited, of course, if the air were in rapid motion, but fog brought in from the sea would remain in spite of wind, provided the temperature were sufficiently low, the seemingly stationary fog being in reality continued condensation of moisture.

If we consider mist as a possible source of our pond-water, then we can understand the use of trees overhanging a pond. This was the case with the ponds on Selborne down, referred to by Gilbert White. Clement Reid has noticed that when a sea-mist drifts in, there is a continuous drip from the smooth leaves of the overhanging tree. He also observes that thick sea-mists often cling to the top of the downs for several hours after sunrise. In the neighbourhood of Chanctonbury a good deal of clay is found in pockets in the chalk, and it has been suggested that the clay is discovered by the mists hanging thereover later in the day than on the chalk, and this may have led to the choice of certain sites for pond construction.

The period of my stay on the downs in 1908 was, on the whole, remarkably free from fog. I have lived, however, many years near the downs, and have constantly rambled over them, and so can speak with a good deal of experience of them. I would add that, though in July, August, and September the downs were very fogless, morning after morning, as I looked out from the hill, the weald was shrouded in mist, with only here and there a higher eminence showing, the tops of trees or the steeples of churches. In a rain-gauge which was kept at Ditchling by Mr. Hope, gardener to Miss Tuppen, the fog was a measurable quantity when no rain had fallen. This fog was lowland fog and of quite a different nature to downland fog. It rose from the low-lying meadows and ditches, whereas the fogs of the downs are of sea origin and are wafted in from the sea.

In 1902 and 1903 Dr. Marloth, of Cape Town, tested the amount of moisture deposited by the south-east winds in blowing over Table mountain, and compared the water found in an ordinary rain-gauge with that found in one which he surrounded with a bunch of short reeds. He gave as a result that from December 21, 1902, to February 15, 1903, that is, in fifty-six days, the gauge with the reeds had condensed a quantity of moisture equivalent to 79·84 inches of rain, and that quantity was recorded, although the last three times the gauge had overflowed. It is not too much to assume, that as the season of the south-east clouds extends over double that time, there would consequently be a condensation of moisture, exclusive of rain, of at least 150 inches during the dry season alone.

This result was so remarkable that it appears to have been received with some amount of scepticism. Further experiments were therefore undertaken. It was found that at a site near Maclear's beacon (3500 feet) the ordinary rainfall for January, 1904, was 1·44 inch, but the gauge with reeds captured 48·42 inches of rain and other moisture. During the same month, at Woodhead reservoir (2496 feet) the ordinary gauge showed 1·83 inch, but that with reeds showed 13·73 inches.

Objection had been taken to the use of a single gauge with reeds, in that reeds and bushes in nature would be screened by others standing in front of them. One gauge was therefore placed in the open, one in the midst of a thicket of bushes 5 feet high, and another in the centre of a field with reeds. There was found, as

was to be expected, that there was actually a considerable screening effect, "but that the quantity which did reach the sheltered gauges during longer periods of south-east clouds was far in excess of the total of the rainfall for the summer months."

I think, in view of this evidence, that vegetation, if overhanging a pond, will be beneficial to the pond. The fact remains, though, that some of the best of the downland ponds have no trees or bushes around them; in fact, it would be almost impossible to grow them in the exposed situations of the ponds. But, on the other hand, they all, or nearly all, have weed and grasses growing in them. The pond to which I have referred as One Tree pond has no weed in it, and it dries up regularly.

There are two ponds between Keymer slipe and Ditchling beacon which I will refer to as No. 3 and No. 4 ponds. The two ponds are not more than half a mile apart, No. 3 being on the north and No. 4 on the south of the horse-track passing along near the brow of the downs. During the drought of last July there was a small shrinkage in the area of both ponds, but this was only noticeable by observing at different dates the clumps of reeds which here and there dotted the edge of the ponds, and also marked stones which I placed in certain positions. In wet weather there would be some drainage into No. 4 pond from the horse-track, and into No. 3 from a clump of gorse at slightly higher ground, but in a drought these would be negligible. There must have been something which kept these ponds, as well as that at Ditchling beacon, fairly filled, although No. 1 had dried up. In the cases of Nos. 3 and 4, I attribute this to (1) dew deposited on the vegetation growing out of the pond and running down the stalks into the water, and (2) to the depth of the water. It is noticeable that these and other ponds have high banks around, but the growth of common grass low down on the inner side of the bank shows that not for a very long time, perhaps never, has the pond been really full. There is a limit to the depth of a perennial downland pond, and probably about 4 feet is the greatest depth, although those that I have met with do not greatly exceed 3 feet.

As regards the sufficiency of rainfall alone to fill the ponds, if we admit the fact, as White informs us, that these strange little ponds on the tops of the hills are full when those in the bottoms are dried up, that is, in times when there has been a dearth of rainfall, it must be evident that rain cannot be the sole means of the replenishment of the ponds. Most of the evidence goes to show that the ponds on the lower ground are the first to suffer in times of drought. This seems to show the necessity of something acting in addition to rain. The ponds on the South downs, which I have numbered as 1 and 3, also show this strikingly. No. 1 (One Tree pond), although 34 feet across (July 22), was very shallow, nowhere being more than a foot deep during the time that I watched it. In the drought, from the middle of July to the end of August, it dried up. Heated day after day by a hot sun, it parted but slowly at night with some of its heat, and the whole of the water was practically of one temperature. On July 24, the thermometer showed 67°·5 at 8.20 p.m., at 1 inch, 6 inches, and 9 inches, whilst that on the bank showed 58°·5. On July 25, at 1.30 p.m., it showed 71° at 1 inch, 6 inches, and 9 inches, while the temperature on the bank was 67°. Evaporation of the pond's water rapidly proceeded, and on August 10 a few pools alone remained. On August 13 one pool remained, and the tracks of a traction engine on the bank showed that nature had received assistance in the drying-up process. No. 3 pond, on the other hand, was a fairly deep pond, about 3 feet deep in the centre. The drought of about four weeks certainly diminished the area of the pond to some extent, but not noticeably, and thermometrical readings showed differences of temperature at various depths. On July 26, at 6 p.m., it was 76° at 1 inch., 74° at

6 inches, 71° at 9 inches. At 8 p.m. the surface (1 inch) had gone down to 70°·75, at 6 inches to 71°, while at 9 inches it remained stationary at 71°. The loss of surface temperature through the night would result in a great saving of loss by evaporation. Thus the shallow pond without weed dried up, and the deeper one with weed lost but little, and in the latter case it could not have been rain that maintained the pond, as the fall had been slight (0·004 on August 5), and both ponds had equally benefited by it. It is quite clear that something besides rain is required.

As regards rainfall, however, an interesting fact came to light. When the hollow had been dug for an experimental pond, I placed a rain-gauge at the bottom and another on the bank above it. The results were as follows:—

1908.	On bank.	In hollow.	In hollow, with straw and grass in rim.	
Aug. 24	0·37	0·41	0·54	Strong S.W. wind.
„ 25	0·01	0·01	—	
„ 26	0·32	0·53	0·69	Gale.
„ 27	0·15	0·21	0·23	Strong wind.
„ 28	0·34	0·43	0·48	
„ 29	0·09	0·10	0·08	
„ 30	0·05	0·04	0·02	Hurricane.
Sept. 1	0·32	0·45	(blown over)	
„ 2	0·05	0·07	Do.	Strong wind.
„ 3	0·46	0·60	0·80	
„ 4	0·08	0·08	0·09	
„ 5	0·01	0·01	—	
„ 9	0·09	0·11	—	
„ 11	0·08	0·08	—	
„ 15	0·11	0·11	—	
„ 16	0·03	0·02	—	
„ 20	0·01	0·01	—	
„ 21	0·04	0·05	—	
„ 22	0·09	0·01	—	
„ 24	0·08	0·06	—	
„ 25	0·09	0·12	—	
	2·57	3·51		

This is to say, that during the period quoted the rainfall into the hollow was nearly 1 inch greater than on the down. When the rainfall on the down was $\frac{1}{10}$ inch or over, that in the hollow exceeded it; if less than $\frac{1}{10}$ inch, then, as a rule, that in the hollow was less.

The third column shows the rain collected in a gauge in the hollow, in which some grasses and straws were arranged in a cluster in the collecting gauge. The hollow was of course empty, so that the top of the gauge may be regarded as being at the level of a pond a foot deep, the grasses representing weeds growing in such a pond. Thus it will be seen that during days of fairly heavy rainfall this third gauge collected more rain than in the case of either of the other two gauges. See particularly August 24, 26, and September 3. So far as these experiments go, it shows that more rain falls into a hollow than on the bank, and more falls into that part of a hollow where there are weeds and grasses than where there are none. From this it would seem to follow that where a pond is dependent on rain for its replenishment, the banks should be high, and grasses should be encouraged to grow in a pond, so long as their roots are not allowed to perforate the bottom.

There is one fact that is sometimes not completely realized, and that is the large

area for drainage which some ponds possess by reason of their broad margins. Three examples will suffice.

No. 3 pond had a margin 28 feet across, although part of this was grass-covered. The pond was about 67 feet across. The pond area = 3333 square feet, and the area of the margin = 8197 square feet.

No. 6 pond (High Park corner) had an uncovered margin 20 feet across, from the edge of the pond to the grass bank. The pond was 76 feet across. Thus the pond = 4120 square feet, and the margin = 5795 square feet.

No. 9 pond (Waterhall) had a margin 15 feet across. The pond was 87 feet across. Thus the pond = 5380 square feet, and the margin = 4618 square feet.

The gathering-ground will thus be seen to be considerable, and this, coupled with the fact that the rainfall is considerably greater in a hollow than around its ridge, may be held to show that rainfall may have a great deal to do with the filling of such ponds. Yet not everything, as has been held by some, and this has been, I consider, sufficiently shown by these ponds which have but slightly suffered during drought, although drawn on by hundreds of sheep day after day during the same period.

While engaged in looking up the scanty literature of the subject, it occurred to me that some light might perhaps be thrown upon the subject of the origin of dew-pond water by analyzing the water contained in a number of downland ponds. Before I did anything in this direction, however, Mr. Sidney Skinner communicated to *Nature* analyses of three ponds, two of which may be termed dew-ponds in the ordinary acceptation of the word. During the summer I collected material from a number of other ponds, and, by the kindness of Mr. Skinner, these have been analyzed by Mr. C. S. Grace at the South-Western Polytechnic, Chelsea. The results are as follows:—

ANALYSES OF POND WATERS.

In parts per 100,000.

Name and number of pond.	Height.	Chlorine (by exp.).	Total hardness (by exp.).	Temporary hardness (diff.).	Permanent hardness (by exp.).
No. 1. One Tree pond ...	700	2·12	8·71	3·42	5·29
„ 5. Ditchling beacon ...	800	3·475	13·91	8·37	5·54
„ 6. High Park Corner	700	3·175	12·41	5·98	6·43
„ 7. Red Worm pond ...	500	12·15	30·20	23·06	7·14
„ 9. Over Waterhall Valley	700	4·50	14·21	9·78	4·43
„ 10. Oblong pond, over Plumpton	700	3·15	6·14	0·85	5·29
„ 11. Round pond, 50 yds. east of No. 10	700	2·70	5·20	0·06	5·14
Ramsbury, Wiltshire ...	693 (inland)	0·75	—	3·6	—
St. Boniface pond	787 (nearsea)	3·5	—	4·3	—
Shanklin pond	(near sea)	3·4	—	7·7	—

The quantity of chlorine found in these is noticeable. In analyses of waters it is usual to regard the chlorine as derived from sodic chloride, although occasionally it may be present as a calcic salt. The specimen from No. 1 pond was obtained after the refilling of the pond, subsequent to the drying-up already referred to. In fact, the refilling may have been due to dew and mist, but certainly the greater part

was rain. It contains the lowest proportion of chlorine of any in the series. It was situated about 5 miles from the sea. Sutton, in his 'Handbook of Volumetric Analysis,' states that unpolluted rain-water usually contains less than one part, but average town sewage about eleven parts. It is scarcely affected by filtration through soil. It is safe to say that there was no question of pollution by animal excreta, and the chlorine came in with the condensed vapour. The rain was brought in with south-west winds and gales, and probably washed down from the atmosphere into the pond a good deal of sea-salt, which had been blown inland. But it is likely also that the mists which blew in from the sea were condensed around finely divided salt nuclei, and this may to some extent have caused the presence of chlorine. Ponds which have been existing for a longer time would naturally, by process of evaporation, have a greater proportion of sodic chloride, and Nos. 5, 6, and 9, which have never been known to empty, bear this out. There is no evidence to show that dew will cause salt to be precipitated with it when the atmosphere contains a normal amount of the latter, although it has been stated that in the neighbourhood of salt-works dew is salt to the taste. I think that real dew, being drawn from a thin stratum of air resting on the soil, would scarcely be likely to contain an appreciable amount of salt, although if we extend the term "dew" to include condensation on the branches and twigs of tall trees, from which it may drip into a receptacle or pond beneath, such a form of condensation is as likely as rain to contain chloride of sodium. The word "dew" should, I think, be confined strictly to that deposited in the lowest stratum of the atmosphere.

No. 7 pond is inserted in the table as a contrast to the others. It is situated at the side of a hill, and there was a good deal of drainage into it. On the face of it, it seems to be a very polluted pond. It was puddled with clay, which lies thickly on the sides of the hills overlooking Pyecombe. The amount of chlorine (12·15) is comparable with that contained in sewage, and probably the extreme hardness was due to the same cause as the excessive chlorine. The temporary hardness of Nos. 5, 6, and 9, $CaCO_3$ for the most part, is no doubt due to the chalk puddling, although that of No. 6 is less than might have been expected. Nos. 10 and 11, bedded in flinty clay, although upon the chalk, show a remarkably small amount of temporary hardness.

I am afraid these analyses do not lead us very far in the solution of the problem as to whether dew or mist have much to do with the filling of the ponds. But they certainly show that whether brought as rain, mist, or dew, the aqueous vapour comes from the sea. It may perhaps be of interest to state that I have made a small experimental pond on the Sussex downs, at Clayton, which I hope is now rapidly filling with the autumn dews and rains. It is too early yet to say what success may await its formation. One must wait for the hot days of another summer. Acting on the principle which has so far been generally accepted, that the pond and puddle must themselves be cooled in order to condense the vapour in the atmosphere, or at any rate to reduce evaporation, I proceeded to select the material which seemed, from numerous experiments, to be the most suitable, and yet was inexpensive. Pond-making is an expensive hobby, and if results are to be in any way of economic value to the farmer and grazier, we must not expect an outlay of a hundred pounds on a single pond, which is not to serve his purpose only, but that of at least two or three future generations on the same farm. Straw is fairly cheap, and would serve to some extent, but if puddled clay were laid down upon it, I fear the consequences would be that the straw would become in the first place moist, and therefore act as a good conductor of the heat of the earth to the water and puddle; and, secondly, the straw, by the crushing weight of the clay, would become so flattened out that much of its non-conducting qualities would become lost. Wood has been seen to be a

good radiator, and it seemed to me that if wooden planks were made to form a slightly raised platform over the straw, excessive crushing would be prevented, and at the same time the wood would act as a buffer between the moist clay and the dry straw. Also, since wood acts as a good radiator and therefore a bad conductor, I essayed an experiment with what has come to be known as wood-wool, so that beneath the straw was thickly strewn a quantity of this non-conducting material. Thus we had from the bottom upwards, a chalk base, wood-wool, straw, wooden planks, and puddled clay. Next was placed a thin layer of powdered chalk, mixed with cement to prevent any untoward trampling through the clay whilst the pond was under construction, and, over this, powdered chalk was thickly strewn, in order to make a rough surface on which the dew would settle, and pending the coming of the rains. The layer of clay projected up the sides beyond the limit of the cement, and also beyond the subjacent straw. The whole was surrounded by a wire-netting fence. When, at some future time, the fence comes to be removed, the surface of the exposed clay layer and the powdered chalk will be worked by cattle into puddling. I have said that it is important that inexpensive materials be used, and I have endeavoured to suggest how this may be carried out. A pond of the usual proportions would, however, even with these economical materials, cost between £30 and £40; whilst if carried out as done in Wiltshire, with three layers, each of straw and puddle, and the digging out of the hollow in the first place, the expense would be about £100.

So far as the name "dew-pond" is concerned, it seems to have not been in use before 1813. Gilbert White does not speak of dew-ponds as such. He was born in 1720, and the utility of making them on high ground seems to have been well known in his days. Walter Johnson, in his recently published 'Folk Memory,' speaks of a work by Christopher Packe, dated 1743, in which he describes a pond near Brabourne, in Kent, 100 feet above the spring below, which was never empty, even after a dry spring and summer. He thought that there was a "condensation of elevated vapours," and this went to feed the pond. He was no doubt correct. Johnson doubts if the present ponds antedate the period of the mediæval sheep-masters, although he thinks there is a likelihood that dew-ponds of some kind were known in the Neolithic and Bronze Ages. Although undoubtedly true that in the Middle Ages the population came to settle in the lowlands as the woods and forests became cleared, we cannot fail to bear in mind that, long prior to such times, there was a population which utilized the hilltops, and bequeathed us the barrows and ancient encampments, and these must have had a water-supply. All efforts to suggest that the source of this was anything but dew-ponds have failed, by a process of the elimination of the unlikely. If it be admitted, as I think is now generally done, that the ancient camps were places of refuge in times of strife for men and cattle, a great quantity of water would be required, even though the period during which a camp was occupied was but a few days. Wells and springs may, after due consideration, be put out of court, and ponds remain the sole source of the water-supply. Puddling by cattle by accident, as suggested by Mr. F. J. Bennett, may have given the experience necessary for the making of a puddled pond, and experience would probably have shown that water remained longest where the chalk was covered with Tertiary or post-Tertiary clays. It is not improbable that some of the ponds are of Neolithic, or of even older age. Their age can, perhaps, be judged to some extent by their surroundings and position, but at best the evidence is but very scanty, and it is so easy to found so much theory upon so little fact. For the present I refrain from further theorizing. I can only add that there is much work yet to be done.

So far as my conclusions have led me at present, a serviceable pond should

be between 3 and 4 feet deep in the centre, with a further vertical rise of the same amount to the top of the surrounding bank. A few clumps of grasses, and reeds or rushes, should be encouraged to grow in the water. A gorse-bush or two should be planted on the south-western side, so that its drip shall be into the pond. The shelving bank should be chalk-puddled, or clay-puddled and smoothed down and rammed hard, or even cemented, to obtain such drainage as is possible. It should be near the head of one of the dry valleys coming from the south or south-west.

Then, in the winter months, such a pond will be recruited by rain, snow, mist, and dew; but in the summer and in times of drought the pond will be preserved from drying up by mist and dew. Grant that the word "dew" includes mist and fog, then in the summer, at any rate, some of the ponds will be entitled to be called "dew-ponds." On this account, therefore, I think the title by which they have come to be known might remain, without the various qualifications of the title which from time to time have been suggested.

Dr. STRAHAN (before the paper): The first paper this afternoon is one by Mr. Martin, giving his observations on dew-ponds. I will at once ask him to give us an abstract of his paper.

Dr. STRAHAN (after the paper): We are indebted to Mr. Martin for what I hope is only a preliminary report on this investigation on dew-ponds which he is carrying out. There remains, evidently, much to be done, and I hope that we may get an account of his future researches at some future period.

Dr. MILL: The paper, I am glad to see, emphasizes the fact that dew has but little to do with the formation of dew-ponds or with the replenishment and maintenance of them. I think, however, it would be a pity if that picturesque name should be allowed to vanish, as it really does not matter whether the name is strictly descriptive of the origin of the pond or not. The observations that have been made, and especially those interesting photographs showing the general breadth of the margin round the ponds, go a long way, in my mind, to prove that rain, using it in the technical sense, is the principal factor in filling and maintaining dew-ponds. One of the first difficulties raised by this statement is the fact that dew-ponds at a high altitude do not get dry in summer, while ordinary ponds at lower altitudes do. It occurs to me to ask whether ponds at a low altitude are made water-tight as carefully as dew-ponds are? Are they not much more liable to leakage? The statement was made in the paper that dew-ponds occur only on chalk soil. There are very similar ponds found on the summit of many other ridges in the neighbourhood of London: along the ridges of Mill Hill and Totteridge there is a chain of ponds on the summit level which, I believe, never dry up, and they have certainly a very restricted drainage area to feed them, and must owe their replenishment to the same cause as the dew-ponds on the South Downs.

With regard to the question of the total amount of rainfall at different elevations, there is no doubt that the gauge in the centre of the newly excavated pond would collect more rain than a gauge on the raised rim of it, but it is not because more rain is falling on the centre of the pond than on the rim, but simply because of the eddies set up by the wind on the more exposed rain-gauge, preventing the rain from entering it. It is one of our greatest difficulties in getting measurements of the rainfall on mountains and high moorlands that the eddies set up by the wind carry away a great deal of the rain, and I now recommend that such gauges should be surrounded by a fence to break the force of the wind. I think that the statement made in the paper as to the rainfall on the downs being lower than that in the adjacent low-lying region of the weald is inaccurate. I have brought here a rainfall map of the south-east of England which I have prepared on the scale of

2 miles to an inch, and it shows that the rainfall in this district is closely related to the configuration of the ground; the highest rainfall occurring on the highest land, and the lowest rainfall on the lowest land. With regard to the relation of evaporation from a water-surface to rainfall, much information is published in *British Rainfall* annually. Observations are being made at thirteen stations in the British Islands. Some of these have been going on for many years, and it has always been found that the evaporation from an open water surface sufficiently large to have a temperature corresponding to that of a reservoir or pond is much less than the rainfall. In a position like the South Downs, the average rainfall will vary from 35 to 40 inches on the summit, and the evaporation there, on account of the wind sweeping over, may be as high as 20 inches, so I should expect that from 15 to 20 inches of water per annum would accumulate in an open straight-sided pond with no drainage area from surrounding land. It is an experiment I am anxious to try; but it presents peculiar difficulties, and it has not yet been made in a satisfactory manner. That trees and shrubs condense or cause water to separate from fog and mist is, of course, well known, and this influence was worked out on Table Mountain by Dr. Marloth to show the influence of a bed of reeds in drawing water from the cloud "tablecloth." One particular make of rain-gauge, the Fleming, was doomed fifty years ago on account of inaccuracy due to this action of a rod. It had a float with a rod attached to it, which rose as the rain-gauge filled, and as it rose it caught so much moisture that the records of these gauges were totally misleading. There is no doubt that a row of trees leaning over a pond, especially on a place like the South Downs, would pour a large quantity of water into the pond, drawn from the mists. It is very difficult to distinguish between rain, mist, and dew in some cases. Condensation of moisture from the atmosphere on the surface of water does sometimes occur in excess of the condensation that would take place in a rain-gauge, and the measurements of evaporation at Camden Square in the winter time show that there is occasionally a slight excess of condensation over evaporation on the average of one or more of the winter months every year. The amount is, however, very trifling. I think that the result of those observations has been important in showing that the exaggerated idea of the enormous power of dew to fill a pond when there is no rain has no physical basis. One would like to see them continued for several years, so as to eliminate what we must call "accidental" variations and find out the real underlying facts. I think the new dew-pond Mr. Martin is making promises well, and I look forward with interest to observations which, to a large extent, should solve the question of what happens on setting down an empty tank and leaving it for a year or two exposed to rainfall and evaporation—only it would be necessary to keep the sheep and also the birds away. We owe Mr. Martin our gratitude for undertaking so interesting and so troublesome an investigation.

Mr. George Hubbard, F.S.A.: As a visitor here I hope that I am not intruding in offering a few words on this subject, which is one that has occupied a good deal of my attention for some years past. I cannot say that I entirely agree with Mr. Martin's view on the subject, and more for the purpose of raising a discussion, I hope I may be allowed to single out those matters upon which I disagree. Mr. Martin says, "I am inclined to think that dew may be received by a pond on its surface, even while a pond has not yet fallen to the dew-point." I submit that this would be physically impossible, unless the surface of the water fell to a lower temperature than the air which lies above it.

The chilling effect which is produced in the temperature of the water of a dew-pond is largely brought about by the incorporation of straw in its foundation. The straw is a good non-conductor of heat, and cuts off the transmission of heat from the

earth to the pond. The water of the pond radiates heat into space during the night, and as the pond is thermally insulated from the earth, the tendency is for the water to reach a lower temperature than it would otherwise attain without a non-conductor of heat below it. I carried out an experiment where I employed mica instead of straw as a non-conductor of heat. I began by excavating the ground and covered the excavated surface with concrete; the concrete was covered with pitch in order to stop moisture rising from below. On this pitch I laid down slabs of mica 24 inches square, and the whole was then covered by a layer of asphalte. During the night some hundreds of gallons of water would be deposited; but as I had unfortunately made no provision for emptying the pond, I lost by evaporation during the day what I had gained during the night by condensation.

According to a statement appearing in Symons' *Meteorological Journal*, which kindly criticized a lecture I gave in March on "Dew-ponds" at the Royal Society of Arts, it appears that the average rainfall on the tops of the South Downs is 35 to 40 inches during the year, whereas the annual evaporation is not more than 20 inches, and so from rain alone there should during the year be an accumulated depth of 15 to 20 inches. It is, however, in waterless lands where dew-ponds may be of great importance, and, since my brother, Dr. Hubbard, and I published our small book, entitled 'Neolithic Dew-ponds and Cattleways,' we have been interested to see that the Government have adopted the principle of obtaining a condensing surface at Gibraltar. A large portion of the rock has been covered with corrugated iron on a wood backing. The iron quickly radiates its heat, and the wood backing acts as a non-conductor. The consequence is that the warm moisture-laden winds coming off the sea are chilled by contact with the iron, and aqueous vapour is deposited on its surface, and now, if we are correctly informed, Gibraltar has for the first time a supply of pure water.

In another locality, dew-ponds might be constructed with great advantage. Twelve miles away from Madeira lie the islands known as the Desertas; they are desert islands, as their name implies, and here the rain is said never to fall. Madeira, of exactly the same geological formation, is one of the most fertile islands on the face of the waters, and the Desertas might be made as beautiful and as prosperous as Madeira if water could be procured. The night air is saturated with moisture, and the few fishermen who inhabit the islands obtain their water-supply by putting out fleeces at night and wringing the dew out of them in the morning.

The conditions are all eminently favourable for the introduction of Dew-ponds in the Desertas; but after the water has once been collected it should be used for the cultivation of trees. If once the trees are reared, then the natural rain will fall. In the Cordilleras clouds with rain falling from them may be seen hanging over the woods, while on the rest of the land the sun is shining.

Mr. Sidney Skinner: I should like to say how very interested I have been in Mr. Martin's paper. I forget how it was that my attention was first called to this subject, but I felt very sceptical about the possibilities of dew-ponds. There seems, however, to be a general concensus of opinion, whether right or wrong, that these dew-ponds do condense water by the method of dew-formation, and that point is worthy of examination. Another point on which information is required, is whether ponds in valleys are made with the great care with which ponds on high levels are made. I have just been spending a short time at Ventnor, and have been watching a pond on the top of St. Boniface down; that pond has a very good puddled bottom. It is very nearly on the actual summit, 787 feet high. I marked the edge of the pond very carefully, and for two days we had a very considerable mist blowing over the pond, and I expected to find some more water in it. I was, however, astonished to find that during this time of mist the pond was getting

emptier. Then we had a day on which some rain fell, and the water went up above the mark at once, and it confirmed me in the opinion, if I may take that single instance, that the chief amount of water must be due to rain entirely, and that such ponds are really very excellently made reservoirs for rain-water, and that the mist did not contribute very much.

Mr. CARLE SALTER: There are a good many meteorological observations in existence which bear almost directly on this subject, and it seems to me that the chief problem is to ascertain how far these observations may be trusted to indicate whether more water is precipitated in so-called dew-ponds than is precipitated on the land around. We know with considerable accuracy how much rain falls, and we know approximately how much evaporation takes place from an exposed water surface, and it only remains to take some observations on how much water the sheep drink to enable us to calculate mathematically whether there is any unaccountable surplus of water in the ponds. It has not, it seems to me, been pointed out by anybody in the course of this discussion, that whilst the collecting area of these ponds is always somewhat larger than the actual water surface, the evaporating area is confined to the water surface, because the margin around the pond is nearly always very efficiently puddled, and although evaporation goes on freely from a chalk surface or from vegetation, I think the amount of evaporation from hardened clay puddle is almost nothing. Therefore, even if there were no more drainage area than the actual margin of the pond above the surface of the water, a comparatively small margin will double the collecting area, without in any way increasing the effective evaporating area. The result of that would be that, supposing the collecting area to be double the actual water surface, and the rainfall 35 inches, we get an equivalent of 70 inches of rainfall in the pond, whereas we can only allow about 20 inches for evaporation; the difference is still greater than the mere difference between the depth of rainfall observed and evaporation observed. This seems to me to suggest that the increase due to rainfall is even greater than has been suggested.

Dr. STRAHAN: You have already testified to your appreciation of Mr. Martin's work, and it only remains for me to ask him to reply to the various remarks that have been made on his paper.

Mr. MARTIN: I am very much obliged to you for the kind way in which you have received my paper. I have to thank Dr. Mill for his remarks on the rainfall of the South Downs. With regard to his remark about retaining the poetical name of dew-pond, I agree with him; I should be sorry to see the term go, and although the dew-ponds may turn out not to be "dew" ponds, I should be very glad to see the name still remain. With regard to the remarks about the amount of rainfall in the hollows, of course that is as pointed out by some of the critics; one does not suppose that the rainfall is greater there, but merely that rain is drawn in by gusts and eddies of wind, and thus a hollow may collect more than would fall on the same area if level. Mr. Hubbard's remarks were interesting, and I wish he had been able to remain, because his remarks are not always, as it seems to me, supported by evidence. He rather jumps at conclusions, I think, without having the necessary proofs. In regard to straw being put underneath the puddled bottom of a pond, this practice bears some resemblance to the practice in vogue in India for the production of ice. The point is, whether or no the straw can remain dry. If it does not remain dry, it is practically of no use. I have not come to any conclusion at present as to the utility of straw, but so far as I can see, I am almost inclined to think that the idea of putting straw *underneath* the puddle, in order to encourage condensation, has not very much foundation in fact. It is, perhaps, put there merely to keep the clay from cracking. I am very much obliged to Mr. Skinner for kindly undertaking the analyses shown in the paper, and for his remarks. I shall bear in

mind what Mr. Salter says as to the evaporation being only from the pond surface, whereas the collecting area includes both pond-area and the area of the margin. I should very much welcome suggestions from any one on points in connection with the subject which might perhaps otherwise be overlooked.

Captain WILSON-BARKER sent the following communication:—

"I much regret I cannot attend Mr. Martin's valuable and interesting paper on 'Dew-ponds,' especially as it is a very interesting subject, the elucidation of which may be of much service. A great deal of mystery surrounds these dew-ponds, and such investigations as Mr. Martin has undertaken should in a short time prove or disprove the question of the formation of dew-ponds. The proof of the general hypothesis on which they are formed might be of great service in finally settling the question of their origin and maintenance, and also point out in what way they could be usefully established, not only in many parts of our own country, where they would be of great service, but also in a number of places abroad. There seems little doubt but that a moisture-laden atmosphere is necessary for their formation, and following on this it is quite natural that those formed on hills will have more chance from the condensation of moisture owing to forcing of air up to the regions in which they are found, then those down in the valley.

"The expense of making such ponds is one necessarily to be taken into account, but the expense is not a great deal more than that entailed in making an ordinary pond, and there are many places where the establishment of such a pond would be of the greatest use to stock-feeders.

"Mr. Martin has given us a most useful and suggestive paper, and I hope that this matter will be taken up practically with the idea of determining whether there are such things as real dew-ponds, and if so, how best they can be formed and utilized for the general benefit."

REVIEWS.

EUROPE.

PLANT DISTRIBUTION IN THE CARPATHIANS.

'Grundzüge der Pflanzenverbreitung in der Karpathen.' II. Band. Von F. PAX. ('Die Vegetation der Erde,' x.) Leipzig: W. Engelmann. 1908. 15*s.* 3*d.*

PROF. PAX's second volume of his study of the Carpathians in the series, 'Die Vegetation der Erde,' is exclusively devoted to the floristic history of these mountains. The main conclusions, however, which condense the results of the exhaustive researches pursued in these parts, will be of interest to the geographer.

The Carpathians consist of older hills of pretertiary origin, and of a younger or eastern portion, the upheaval of which only came to an end during the Miocene times. The long but lower range of the Wald Karpathen came to light later, a bridge between the two isolated portions. In the preglacial period, the whole range enjoyed a moist subtropical climate, similar to that of the tea forests or the South-eastern portion of the United States. It was gradually replaced by mediterranean and later on by pontic conditions, new vegetable forms being developed each time alike by slow modification and by invasion from the South and East. But whereas in the West all traces of the former flora were wiped out by glaciation, the Eastern Carpathians were affected by the ice-period, only in a much lesser degree, and a number of the older forms survived the ordeal. At the same time the mountains were being invaded by the boreal-arctic flora. As conditions improved the invaders

retreated to the upper reaches, along with the original alpine elements, while the Western ranges were colonized by centro-european and alpine new-comers. The Eastern Carpathians soon renewed their connection with the Balkans, receiving a strong contingent of pontic, dacic, and southern alpine plants. This was especially the case when the climate gradually assumed a drier, steppian character. Although there has been an abundant interchange between East and West by means of the Waldkarpathian bridge, both portions have retained in the main their individuality. The result being ultimately, as a consequence of the glacial times, that the geologically older West Carpathians possess the younger flora. Why the Carpathians should, contrary to our expectations, be considerably poorer in plants than the Sudeten, is not satisfactorily explained by the writer.

In the present volume the map is rather poor, and the illustrations exclusively of herbarium interest.

M. H.

Man and His Environment in Normandy.

'Les Paysans de la Normandie Orientale.' Étude géographique. Jules Sion. Paris: Librairie Armand Colin. 1909. 12 *fr.*

This work endeavours to describe the physical environment as mankind found it in Eastern Normandy, and then goes on to trace the influences of that environment on the life of the inhabitants, together with the complex reactions of human activities on the characters of the district. In choosing Eastern Normandy from Dieppe to Rouen and from Fécamp to Beauvais for his field of study, the author has assuredly found a countryside which speaks everywhere of centuries of human thought and work, and his illustrations of typical scenes are of much interest from this standpoint.

The study of the climate of Eastern Normandy precedes a discussion of the division of the country into natural regions. As examples of these may be adduced, the fertile plateau of Caux, with its chalk rocks covered by alluvium; the various valleys floored by clays often rich in flints, which have come from the chalk; and the marshy valley and seaward broadening of the river Seine.

The section dealing with early man and racial history is necessarily imperfect, for no one has yet studied the actual population of Normandy from this standpoint as Collignon did that of Brittany and parts of the Dordogne, and as Beddoe did that of Western Britain a generation ago. Even so, it is regrettable that the author has made the arrival of the Northmen so particularly and almost exclusively a fact of the eighth and ninth centuries; though so much is still in doubt, modern anthropology assuredly sees that the Northmen were spreading from the narrow valleys of Scandinavia right on from prehistoric times.

For the Middle Ages, Sion has behind him the great work of Leopold Victor Delisle on the agricultural population of Normandy in the thirteenth century, to which classic many paragraphs of the present essay furnish a useful geographical commentary. Sion argues for the early settlement of Caux, and supposes that the rarity of flint implements and other evidences of occupation is due to their disappearance in the course of long and intense cultivation.

The valleys of the Seine tributaries, and those of Bray as well, long remained wild as stretches of forest and marsh, and it is in these regions that the abbeys of the early Middle Ages were founded. The land was then still available for gifts. Henceforward, the story is of the clearing of forests and of conflicts between the claims of the peasantry and those of feudal nobles and religious houses.

The peasant rights of general free pasture, *banon*, through the autumn and winter are a characteristic feature of the village of those days, a feature which has been lost by the eighteenth century, the next period Sion treats in detail on the

basis of an extensive study of official records. In preparation for the study of this period the growth of the weaving industry is traced, and England is seen as, at first, an outlying undeveloped country supplying wool as raw material to the industrially organized districts of Flanders and Normandy, both great centres of European trade. From the reign of Edward III. onwards England wove an increasing proportion of its own wool, and this and the growth of luxury helped to develop the weaving of silk and of flax in France. Rouen is the focus of the history of Norman industries, and Sion treats it as a port with a bridge, which made it an important road centre, and added overland trade to its traffic by sea. The woollen, the linen, and latterly, the cotton industries have given Rouen its prosperity; but that was endangered at one time through the growth of artificial formalities and restrictions, which resulted in the scattering of the weavers among the villages of Eastern Normandy. The village weavers are an important fact in the geographical development of Normandy, but they have disappeared as machinery has become more complex.

M. Sion expounds in great detail the modern conditions in his chosen district, the decay of wine and corn-growing as overland importation became easier, and the substitution of pasture for cultivation as the business of supplying large cities—Rouen, Havre, Paris, and London—with meat and dairy produce has become more important.

The reader of this work will be tempted to hope that some day the local and provincial authorities of Britain may read studies of this kind, which would be invaluable helps towards working out an evolutionist and non-partisan policy for the healthy economic and social development of the districts under their charge. There is an exhaustive bibliography, and a few maps and figures are scattered through the text, but the foreign student, at any rate, feels the great lack of maps designed by the author to illustrate the argument, and especially the details which bristle throughout the introductory account of the physical geography of Normandy.

H. J. F.

ASIA.

Western Baluchistan.

'The Frontiers of Baluchistan.' By G. P. Tate. London: Witherby & Co. 1909. 12*s.* 6*d.* *net.*

Out of the story of the Boundary Mission which was deputed, under Sir Henry MacMahon, to determine the frontier-line between Persian and Afghan Seistan, Mr. Tate has evolved a very readable book on the geography of Western Baluchistan generally, which contains the most consistent account of that country yet published. However full the archives of the Indian Government may be of official reports and graphic descriptions of that little-known border-land, no comprehensive view of it has ever been offered to the public. With the assistance of a well-selected series of photographic illustrations, the most striking features of the deserts and mountains which border the Helmund river are brought under review by Mr. Tate, and cannot fail to impress even the most casual reader with their weird magnificence and aloofness. The chief interest of the book, however, undoubtedly centres in Seistan. It is not so very long ago that Seistan presented a military problem in connection with the defence of India of sufficient importance to demand the appointment of a political resident there, who should be able to watch the drift of events in case of any specially active interest which might be extended in that direction by Russia. As a matter of fact, Russia has always been interested in Seistan. So have we. History informs us that Seistan has been more than once a convenient rendezvous for incursions towards the Indian border, although there is no record of any invading

force ever having been concentrated in Seistan for the purpose of penetration into India itself. It is the rise of Quetta into significance, and the fact that we have an open road through the once impenetrable barrier of frontier hills connecting Quetta with India, that gives value to Seistan as a point of vantage to a modern invader; and much consequently depends on the nature of that comparative oasis in the vast desert spaces of Western Afghanistan and Eastern Persia as a harbour of refuge and a source of supply. On points such as these Mr. Tate's book gives one incidentally (for questions of military strategy or of frontier policy are carefully avoided) much valuable information. On the whole, it confirms what was previously gathered by official travellers, such as the members of the Russo-Afghan Boundary Commission of 1885, or later by Colonel Molesworth Sykes or Colonel C. E. Yate. As a country of certain limited possibilities of development, it may be regarded as a useful commercial outpost; and as a frontier political sentry-box, it has undoubted value; but as the "granary of Asia" (for so it was anciently called), Seistan is an absolute fraud. The admirable little map at the end of the book requires but a glance in order to realize the remarkable specialities in conformation and climate which distinguish this most weird country. From the local Jahannum (or "hell") in the south, to the intricate network of waterways and swamps on the north, it seems to be the playground of the elements. Huge bodies of silt come rolling down with the water of the Helmund, and are drifted and spread over the area of the low-lying spaces of the north by countless rivulets and channels. Then the earth dries, the swamps recede, the great Hamúns, or lakes, present their flat floors to the scorching sun, and terrific gales of the north-west, raging with irresistible fury, scoring deep rifts in the alluvial terraces and wearing down all artificial opposition, sweep back these tons of surface sand and silt, scattering them again far and wide in the southern deserts. Thus do whole villages become sand-drifted and decently buried in the course of a year or so, and thus it is that a vast area of country is disfigured with the dried bones of ruins uncountable. Is there any other country known where 500 square miles of ruins may be reckoned up in one solid block? But the winds are to a certain extent beneficent. They sweep out the plague of insects which at certain seasons makes even animal life unendurable. Then there is a recognized snake season, and also a season of floods when it is barely possible to move. Added to these incidents, famine is but too frequent a visitation, and Tate has a ghastly story to tell of human creatures and birds of prey alike awaiting the final gasp of the fallen camel, which dies of disease in Seistan with quite abnormal suddenness. And there is the additional horror of hydrophobia spread by the ravages of mad wolves and jackals, which particular plague appeared to follow the mission out of Seistan. But if from all this one turns to the pictured beauty of Seistan at its best, to the pretty little scene of white-sailed craft on the still pools of willow-fringed canals, or to the vivid description by the author of wild beauty of flowering tamarisk forests, or even the grandeur of the rock scenery (such, for instance, as the Neza-i-Sultan) of the Baluch frontier, one recognizes that it is the force of these strong contrasts of nature's moods and dispositions after all that lends such fascination to the work of exploration. Thus may one hear (as the writer has heard) the wild west of Baluchistan described at one and the same time as a healthful, life-giving desert paradise, or as the dumping-ground for the refuse of God's creation.

The fault of the book is a certain want of sequence in its arrangement, which makes it difficult to follow the results of any one special line of scientific research. This is particularly the case as regards the investigation of old ruins, and the nature of those "finds," which might indicate their age. On the whole, these ruins are all comparatively modern—all that there is above ground, that is to say. The wind has

taken care of that. But underground must lie the remains of cities coeval with the Assyrian Empire, cities almost as ancient as Balkh, and the manner of brick building must have been that of Mesopotamia, not that of India. Seistan was never "Indian" or "Buddhist" like those other sand-covered regions in Turkestan. Geographically cut off from the Indus and Sind by the deserts (which were passable with difficulty) and the frontier barrier of hills (which were not passable at all south of Kalat), Seistan may be regarded, like Herat, as an extreme outpost of the West rather than of the East. Neither Greeks nor Arabs passed through Seistan to India direct; but nothing short of deep digging in Seistan will ever reveal its most ancient history. It is a pity that the mission had no time to dig. Mr. Tate's book will find its place in all frontier libraries, inasmuch as it may be regarded as containing the "last word" on Western Baluchistan and Seistan. It is well worth reading.

West Central Asia.

'Autour de l'Afghanistan.' Par Commandant de Bouillane de Lacoste. Paris: Hachette. 1908. 12 *fr.*

'Around Afghanistan.' Translated from the French by J. G. Anderson. London: Pitman. 1909. 10*s.* 6*d. net.*

A French view of the Central Asian question, based on a comprehensive tour through some of the chief countries connected therewith, is not unwelcome, even though Afghanistan be excluded from the scope of the journey. The title of the work is strictly correct, speaking topographically, as the author's route describes a complete periphery around the Amir's dominions. It starts from Teheran and proceeds to Meshed, after which it crosses into Russian territory and proceeds *viâ* Askabad by rail to Kokand and Andijan. Thence comes the more interesting part of the journey, from a geographical point of view, as it leads southwards over the Alai and Trans-Alai ranges, and across the Pamirs to the upper reaches of the Sarikol river and Taghdumbash Pamir. The author's intention was to cross the eastern watershed from the Tagdumbash side into the upper Raskam valley, but his guides were deterred from attempting this by the alarming reports of the natives as to the dangers of the pass. Consequently the party was forced to take the Sar-i-kol route to Yarkand leading past Tash-Kurgan fort, of which a capital photograph is supplied. This leads us to remark that the numerous photographs, so profusely scattered throughout the book, are really excellent, not only in the selection of typical and characteristic scenes, but also because of their remarkably clear reproduction. From Yarkand the route led southwards to Leh over the Karakoram pass and thence to Srinagar. As a record of Central Asian travel, the narrative, though containing little novelty, supplies a faithful and picturesque description of the difficulties experienced in the rough and comparatively unfrequented tracts traversed: the political comments are furnished in a preface by Mr. Georges Leygues entitled "Le Problème Asiatique," but this is based on French and Russian disquisitions of a somewhat intolerant and exaggerated character, contrasting with the author's comments and reflections, which are characterized generally by perception and common sense.

An English translation of the work has also been issued in an attractive get-up, with the original sketch-maps and illustrations.

T. H. H.

AMERICA.

Archæological Work in Yucatan.

'Le Yucatan Inconnu.' Par M. le Comte Maurice de Périgny. [Paris: 1909.]

This is a short account of a journey in 1906–7 in the south-east portion of Yucatan in search of the ruins of ancient Maya buildings and sculptures. M. de

Périgny ascended the Rio Hondo, which for the distance of about 60 miles forms the boundary between British Honduras and Yucatan; then, leaving the river, he rode 18 leagues through the forest to the village of Icaiché. Up to the last few years this has been a disturbed district and almost closed to travellers. The Indians of Chan Santa Cruz to the north were for many years hostile to the Mexican Government, and maintained a state of independence. Icaiché and some of the neighbouring villages were refuges for all the runaway rascals from Guatemala, Belize, and Yucatan. Now the whole district has come under the government of Mexico, and beyond the usual difficulty of engaging labourers to work at clearing ruins in the forest, M. de Périgny met with no impediment to his explorations. Between Icaiché and the Rio Hondo M. de Périgny located four groups of ruins, and a fourth group which he calls Rio Beque about 20 miles to the north of Icaiché. This last group of ruins appears to have been the most important of those discovered, and contains one building differing considerably in form from others that the traveller had seen in Peten or Yucatan. The principal façade faces the north and measures 40 metres in length, and is flanked at each extremity by a tower built of stones and earth cased in masonry. The angles of these towers are rounded, and in each tower a narrow stairway gives access to two interior chambers. Four photographs of this building are given.

It is very remarkable that, although the ruins visited are within 50 or 60 miles of Tikál, and about the same distance from the ruins at Naranjo and Yaxhá, lately described by Mr. Teobert Maler, all of which abound with carved stelæ and other sculpture, M. de Périgny was not successful in discovering any sculptured stelæ or inscriptions. Such monuments are certainly rare among the ruins of Yucatan, and it may be that the Rio Hondo marks a portion of the boundary between the Yucatec and Central American culture. However, M. de Périgny notes that all the ruins he visited on this journey are in an advanced state of decay, and it is possible that sculptured stelæ still lie hidden under the great masses of fallen stone. Throughout the route traversed were found the remains of walls, and mounds of stones, probably the foundations of ancient buildings, proofs of the former existence of a large population, and, although M. de Périgny must be condoled with on his ill luck in not discovering any carved monuments or inscriptions, his journey through this little-known country is none the less valuable as helping to close the void between the interesting ruins in Guatemala and the great ruined towns of northern Yucatan.

A. P. M.

South American Travels.

'Reisestudien aus dem Westlichen Süd-Amerika.' Von Therese Prinzessin von Bayern. Berlin: D. Reimer. 1908. 20*m*.

An elaborate and painstaking account of the carefully planned and well-equipped expedition led by the princess in 1898, up and down the Columbian Magdalena and along the Pacific coast of South America. Short side trips were taken to the Andes, and a longer excursion from Arequipa up to La Paz, and therefrom through "punas" and deserts down again to Antofagasta. The return journey took her from Valparaiso to Buenos Ayres through the Andes and pampas. The scientific results have already appeared in a number of special papers.

Though the princess broke no fresh ground, she collected quite a wealth of biological and human documents for the state museum of Bavaria, and took extraordinarily copious notes, the full detail of which is given here. Generalities about Columbia, Ecuador, Peru, Bolivia, Chile, and Argentine are well condensed each in a separate chapter. There is also a valuable collection of photographs and sketches. The work is handsomely produced, and contains, beside elaborate maps, catalogues of all the materials collected and a copious bibliography.

M. H.

A Journey in Southern Colombia.

'Miguel Triana. Por el sur de Colombia: excursión pintoresca y científica al Putumayo.' Prologo de S. Perez Triana. Paris: Garnier Hermanos. [1908.]

Within the past few years the Governments of Bolivia, Perú, Ecuador, and Colombia have recognized the importance of opening transitable roads between the Andean tablelands and the navigable affluents of the Amazon. In all cases, however, the limited resources of these countries have impeded the realization of the projects, although the reports upon them have invariably pictured the vast wealth of the districts penetrated. The lowest pass between the Pacific ocean and the Amazon valley is at 7° 45′ S. lat., and only about 7170 feet above sea-level. Thence the cordillera gradually rises, some of the passes in Ecuador reaching 10,000 feet, at which elevation, more or less, one may also cross Southern Colombia to the upper waters of the Putumayo and Caquetá rivers by way of the sleepy town of Pastro. It is this route which was traversed by the Colombian civil engineer, the author of the book under review, his object being a somewhat informal examination of the country, and to report to the Government on the advantages which might accrue by connecting Pastro by a good road with the rivers mentioned. His report, which is confined to only the last dozen pages of his book, gives data of much geographical value.

It should not be forgotten that, in 1874, the present progressive President of Colombia descended the Putumayo 1000 miles to its mouth by canoe, and soon afterwards established steam navigation upon it. Codazzi spent a long period of time among its headwaters. Dr. Crevaux mapped the river as far up as Cuemby, ascending it 800 miles by steamer, finding no obstruction for craft drawing 6 feet of water. It is probably the most navigable branch of the Amazon, and if southern Colombia could utilize it, it would become a great boon to a vast area of the republic. Doubtless Señor Triana's mission had this partly in view, but he made his explorations with the scantiest resources; in fact, one may marvel at what he accomplished with the meagre means at his disposal.

Señor Triana commenced his voyage at Tumaco, which, when I visited it many years ago, seemed to be a dreamy tropical island which had drifted up against the mainland of Colombia. Thence he found his way by a little steamer to the ancient port of Barbacoas by way of the river Telembi, which cuts through the great swampy district bordering the outlying foothills of the coast cordillera. Then by the wretched mule-track which has for centuries served as the outlet of the interior, Señor Triana arrived at Pasto. It must be the centre of a thriving district, for "According to the census, there cannot be a city in the world where there are more priests."

At Pasto the real work of our author began. South of the city about 20 miles is La Cocha, or the Laguna, as it is locally called. This lake is the source of the Guaimés branch of the Putumayo river, and is about 9000 feet above sea-level. Señor Triana skirted the lake, reached the Guaimés, embarked in a canoe, and descended this torrential and much obstructed stream to its junction with the Putumayo. Thence, turning northward, he ascended the Guineo branch of the latter river and crossed the very short, almost level water-divide to Mocoa, on the Mocoa affluent of the Caquetá, which, by track, he ascended to the valley of Sibundoy, separated from Pasto by the narrow cordillera of Patascoy. He found the elevation of the pass to be 11,000 feet, and the junction of the Guamiés and Pilcomayo 820 feet above the sea, the latter being another confirmation of the level character which the Amazon valley preserves from the sea to the base of the Andes.

Judging from the author's barometric observations and description of his route, the country between Pasto and the Caquetá and Putumayo presents formidable difficulties to the construction and maintenance of a cart road.

Señor Triana has the rare gift of making the reader of his book travel with him. From every rock, stream, shrub, tree, hill, and mountain he evolves an atmosphere to which he gives eloquent expression, and although in general his pages seem to lack hard facts, the reader feels that he has been taken through the country and has learned everything regarding its salient features, its resources, and its varied types of inhabitants, and that he has been the companion of a keen observer, a philosopher, and a many-sided man.

G. E. Church.

The Panama Canal.

'The Panama Canal and its Makers.' By Vaughan Cornish. London: Fisher Unwin. 1909. Pp. 192. *Map and Illustrations.* 5*s.*

This volume is an outcome of Dr. Cornish's independent tour of inspection over the Panama canal works, and is no less interesting a study than would be expected from him. He deals with the history of the enterprise, with the present works, at special length with that important section the Culebra cut, with the conditions of labour and health on the isthmus, with the effect of the opening of the canal on maritime communications and trade, and with that somewhat problematical question, the cost of the work. The map prepared for this *Journal* finds a place in the book, and there are numerous photographs, not always quite successful; but engineering works in progress are a difficult subject for the camera.

GENERAL.

Evolution of Civilization.

'The Rise of Man.' By Colonel C. R. Conder, LL.D. London: Murray. 1908. viii. + 368 pp. 12*s. net.*

The main object of this work is indicated, not by the title, but by the familiar lines quoted from *In Memoriam* on the title-page about the "one far off divine event to which the whole creation moves." Colonel Conder is favourably known as a distinguished archæologist, for many years conductor of the Survey of Palestine. But, although there are some commendable features in the present work, the hand of the amateur is too frequently betrayed in its general treatment, not only of the early, but even of the later (historic) periods. What, for instance, will anthropologists say to the statements that "skulls of prehistoric man are as yet only known in the west of Europe, and *all these belong to the Neolithic age*," and that of his palæolithic predecessors "we have no information at all, since *not a single skull or bone has been found*?" (italics mine).

Then the long-exploded Finno-Basque relations are revived, and we are told that the Basque tongue is "nearest akin to the Finnish," with which it has really no connection. The suggestion that "blubber lips among negroes and Mongols may have developed from exclusive (*sic*) eating of flesh" may pass as an anatomical curiosity; but a strong protest must be entered against the assumption that the New World was discovered by the Chinese "a thousand years before the advent of Columbus." Here the reference obviously is to the early Buddhist migration to the shadowy land of Fusang, which was wrongly supposed to be some part of America, and on which were based many wild theories regarding Asiatic influences on American civilized peoples. Thus our author first states that the Hindus "through Japan and the south left their mark in later times in both Mexico and Peru," and then says that the Incas "introduced Mongol civilization and the

Indian calendar," and elsewhere takes seriously Ranking's suggestion that "Manco-Capac, the first Inca, was a son of the Mongol emperor Kublai Khan." It is further supposed that the source of these cultures may not after all have been the Hindus, the Mongols, or the Chinese Buddhists, but the Malays, who may have made their way from the Malay peninsula across the Pacific ocean to Easter island. It may be pointed out that the Peruvian and Aztec cultures could not possibly have been derived from half a dozen different Asiatic peoples, the less so since they are themselves independent developments, differing profoundly one from the other.

Coming to the historic section, the reader is startled by finding Edward III. amongst the Crusaders, making peace at Acre in 1272, and a treaty with Venice in 1325, while Edward II. was still reigning. Then Columbus, born in 1445, interviews Boccaccio, who died in 1375. What "the declining days of the early (*sic*) seventeenth century" may mean is not clear, but to this period Cervantes (*ob.* 1616), Velasquez (*ob.* 1660), and Murillo (*ob.* 1682), are all alike referred. Roman history fares no better, the Cimbri being described as reaching Gaul in 500 B.C., centuries before either Gaul or the Cimbri were known to the Romans. Nevertheless, both the Roman and Greek sections are, on the whole, very well treated.

A. H. K.

Dr. Reich's Handbook of Geography.

'Handbook of Geography: Descriptive and Mathematical.' By Emil Reich. 2 vols. London: Duckworth & Son. 1908. *Price* (vol. 1) *7s. 6d. net*; (vol 2) *5s. net.*

Dr. Reich declares himself to be a firm believer in the "immense importance of geographical factors both on past history and on present life." "Geopolitics . . . is one of the most decisive elements in human institutions." After this introduction, we turn to his pages with interest, to examine his treatment of geography, and more particularly of geopolitics. We find one volume devoted to geographical physiognomies, and one to mathematical geography. These, the author informs us, have been compiled from the best geographical authorities, in twelve different languages, modified by the author's own personal observations.

Frankly, the results are very disappointing. In spite of a number of deviations from standard English, Dr. Reich handles our language remarkably well. It is in the selection and arrangement of the matter that he fails. Not only does he not bring out the immense importance of the geographical factor on the past or present, nor give us any outlines of the subject of geo-politics, but much of what he does write is found to be very loose and misleading. In the sixteen pages devoted to the British Isles there are either actual misstatements or statements which might have been expressed better on fourteen of them. For instance, we find, "If English temperature is happy in its equality, it has to pay for these advantages by an almost constant belt of fogs and mists." "A line drawn along the Downs marks the watershed of the southern streams." "Kinsale, which was not only founded by Spaniards, but from 1381 to 1601 was actually a possession of Spain." "Ireland has no peaks at all comparable in altitude with those of Scotland and Wales. . . ."

If we turn to South Africa, we again find such inexactitudes as, "The Tugela, which forms the northern boundary of Natal." "The lower terrace includes the actual Cape Colony . . . lying up to 300 metres (about 1000 feet) above sea-level." "From the Indian ocean blows the monsoon or south wind." "The entire trade of the colony goes through Cape Town." "Of the Crown Colony, Vryburg is the chief town, occupied by Europeans."

Perhaps the following is an example of Dr. Reich's geo-politics. If so, it is sufficient to damage a much better book than this one: "Bristol appears to enjoy an ideal position as a great seaport, but its harbour is nevertheless decadent.

Albeit Bristol is several hours nearer America, and is much more conveniently placed with relation to London, it has steadily declined in favour of its rival, Liverpool. The latter, it is true, is the port of an immense industrial district, but is this a sufficient explanation? It is certainly worth noting that the citizens of Bristol displayed a most active anti-foreigner policy, excluding aliens from their privileges, and would not allow them to settle except on a footing of abject inferiority. At the same time it should be remembered that the two most thriving towns of South Wales, Milford and Swansea, were founded at the end of the twelfth century by refugees from Flanders, driven from home by the floods."

The Astronomical Geography is better than the Descriptive. The figures and text of the map projections seemed strangely familiar, and on turning to Gelcich and Sauter's *Kartenkunde* revised by Dinse (Leipzig: G. J. Göschen'sche Verlagshandlung, 1901) we found not only many of the figures, but also the source of a considerable proportion of the text. A part of the index of Dr. Reich's work after p. 67 may be compared with that of the German work.

TOPOGRAPHY.	TOPOGRAPHIE.
CLASSIFICATION OF MAPS.	EINTEILUNG DER KARTEN.
Names and general classification of maps.	Name und allgemeine Einteilung der Karten.
According to their scale of reduction.	Verjüngungsverhältnis. Einteilung der Karten nach dem Verjüngungsverhältnis.
According to their destination.	Einteilung der Karten nach ihrer Bestimmung.
GRAPHIC REPRESENTATION OF THE CONDITION OF THE SOIL, ALTITUDE, ETC.	GRAPHISCHE DARSTELLUNG DER BODENBESCHAFFENHEIT.
Projection of position.	Situationsentwurf.
Unevenness of the soil. Sea-level.	Die Bodenunebenheiten. Meeresniveau.
Method of horizontal section-lines.	Methode der Horizontal-Schichtenlinien.
Representation of comparative heights by colouring and shading.	Darstellung der Höhenverhältnisse durch Farben u. Schattierung.
Combination of section-lines and the linear method.	Vereinigung von Schichtenlinien und Schraffen.
	Reliefkarten.

From the text we take a few sample sentences from different pages.

By the laws of perspective we represent an object on a flat surface as it appears to us from some given distance. This flat surface, upon which the representation is to be made, is called the plane of projection. We draw from some point of vision O (Fig. 37) three straight lines to the extreme points of a triangle, ABC, situated outside the plane of projection, and extending these lines until they touch the plane of projection MN, the lines of contact between these extreme points of contact with the plane form a second triangle, *abc*, which

Man versteht unter Perspektive das Verfahren, welches beobachtet werden muss, um körperliche Gegenstände auf einer Ebene so zu zeichnen wie sie sich von einer gegebenen Entfernung aus dem betrachtenden Auge darstellen. Diese Ebene, auf der die Abbildung oder Zeichnung erfolgen soll, nennt man die Bildebene. Führt man vom Augpunkte O (Fig. 4) eines Beobachters drei Gerade nach den Eckpunkten eines ausserhalb der Bildebene liegenden Dreiecks ABC und verlängert man erstere, bis sie die Bildebene MN treffen,

is the perspective projection of the triangle ABC, situated outside the plane of projection. The straight lines *Oa*, *Ob*, *Oc*, drawn from the point O to the extreme points, are called the rays of vision or of projection (pp. 73, 74).

The stereographic projection has two important properties—

1. The stereographic projections of all spherical circles not passing through the eye are again circles.

2. All angles on the spherical surface are equal to the angles in the projection —that is to say, the projection is equiangular.

The spherical circle and its projection lie on one and the same spherical surface; but the projection lies also on the plane of projection MN; therefore the projection lies on a sphere, and at the same time on a plane, and consequently must always be a circle.

To prove the theorem of the equality of angles, we take Fig. 49. Let *xy* and *uz* be circles, and A their point of intersection. We draw tangents AF and AG, etc. (pp. 94, 95).

The Greeks called their land-maps *πίναξ*, the Romans *orbis pictus*, from which the old German word *Land-tafel* has been derived. The Latin *charta* means originally record, letter, or information, but occurs as early as the fourteenth century in reference to land-maps. The expression *mappa* dates from the ancient pictorial land-maps painted on canvas. Here, in England, we still distinguish *maps* (land-maps) and *charts* (sea-maps). The name *atlas* for a collection of maps owes its origin to Mercator's great cosmographical work; his heirs transferred the name, which originally belonged to the entire work, to a part of it, the collection of maps (p. 132).

so geben die Verbindungslinien der Treffpunkte wieder ein Dreieck *abc*, welches die perspektivische Projektion des ausserhalb der Bildebene liegenden Dreiecks ABC bildet. Die vom Augpunkte zu den Ecken gezogenen Geraden *Oa*, *Ob*, *Oc* nennt man Seh- oder Projectionsstrahlen (pp. 15, 16).

Der stereographischen Projektion kommen folgende wichtige Eigenschaften zu—

1. Die stereographischen Projektionen aller Kugelkreise welche nicht durch den Augpunkt gehen, werden wiederum Kreise.

2. Alle Winkel auf der Kugel oberfläche sind gleich den Winkeln in der Projektion, d. h., die Projektion ist winkeltreu im unendlich Kleinen.

Es liegt somit der Kugelkreis und seine Projektion auf einer und derselben Kugelfläche; da aber die Projektion auch in der Ebene MN liegt, so liegt sie auf einer Kugel und in einer Ebene zugleich, kann also nichts anders als ein Kreis sein.

Um die Eigenschaft der Winkeltreue zu beweisen, legen wir (Fig. 15) an die Kugelkreise *xy* und *uz* in deren Schnittpunkt A die Tangenten AF und AG an, etc. (pp. 42, 43).

Die Griechen bezeichneten ihre Erdkarten mit dem Worte *πίναξ*, die Römer mit dem Worte *orbis pictus*, nach welchem die ältere deutsche Bezeichnung "Landtafel" gebildet ist. Das lateinische *charta* bedeutet ursprünglich "Urkunde, Brief, Bericht," kommt aber schon seit dem 14 Jahrhundert auch als Bezeichnung für eine Landkarte vor. Der Ausdruck *mappa* stammt von den alten, auf Stoffe gemalten Ländergemälden. Im Englischen unterscheidet man noch heute *maps* (Landkarten) und *charts* (Seekarten). Der Name "Atlas" für eine Sammlung von Karten stammt von dem grossen kosmographischen Werke Merkators her; schon Merkators Erben haben den Namen, der ursprünglich dem Ganzen zukam, auf einen Teil desselben, die Kartensammlung, übertragen (p. 109).

These are but a few examples of the wonderful similarities between parts of the two works.

No doubt it is very flattering to the authors of the German work to read the paragraph in the preface which says—

"The author may state that he has always paid close attention to the history and technique of mathematical geography, and on compiling the present essay he has drawn only on such sources as he has, from personal experience of study and instruction, found really useful in the comprehension of the subject."

Most authors, we expect, would prefer a more personal and substantial acknowledgment than these German ones receive!

A. J. Herbertson.

SHORT NOTICES.

Europe.—'The Story of the Tweed.' By the Rt. Hon. Sir Herbert Maxwell. (London: Nisbet. 1909. Pp. 374. *Illustrations.* 6s.) The course of the Tweed, with its tributaries, is described in detail in this attractive volume, in which border history and poetry are freely laid under contribution. The author appears to know every inch of Tweeddale, and the story of every important spot no less intimately. The book is of the best type of topographical essay.

'Royal Palaces of Spain.' By A. F. Calvert. (London: Lane. 1909. Pp. xiv. + 107, and 164 plates. 3*s.* 6*d.*) This is a volume of the well-known "Spanish Series," in which photographic reproduction plays such an important part. The views of the palaces and photographs of the details of their art and architecture are fully up to the standard of the series, which, it may be added, is to number twenty-three volumes. Mr. Calvert's text is interesting.

Asia.—'Opinions Chinoises sur les Barbares d'Occident.' By Comt. Harfeld. (Paris: Plon-Nourrit. 1909. Pp. 308. *Illustrations.*) In point of fact, a large part of this book consists of French opinions on the barbarians of the East. Much of it makes interesting reading, and is of real ethnographical value; but when photographs of Chinese tortures are provided on a perforated sheet, so that they can be removed by the more fastidious, it may be felt that research can be carried too far.

Africa.—'The Life of George Grenfell.' By G. Hawker. (London: Religious Tract Society. 1909. Pp. xxvi., 587. *Maps and Illustrations.* 6*s.*) Sir Harry Johnston has dealt with Grenfell's work as an explorer; it is Mr. Hawker's task to deal with his missionary work. The two, however, are so intimately connected that both books should be read for the proper appreciation of this great life. Mr. Hawker quotes extensively from Grenfell's letters, which in style and matter are instinct with individuality. The book is beautifully produced considering its low price, and contains a good coloured map.

'The Handbook of Nyasaland.' (Zomba: The Government Printer. 1909. Pp. 292. *Illustrations.* 3*s.* 6*d.*) This, though not an official publication, is drawn largely from official sources. It is an annual appearing for the first time, and is very welcome; there might well be more such publications. It deals with Nyasaland in an encyclopædic manner; the geographical, geological, zoological, ethnographical, political, and economic aspects are all as fully treated as the size of the volume will allow, and the information given is the more complete as there is, of course, no attempt at picturesqueness. The photographs, however, are very good.

'Natal: an illustrated official Railway Guide and Handbook of General Information.' By C. W. Francis Harrison. (London: Payne Jennings. 1903. Pp. xii., 300. *Maps and Illustrations.*) This is a beautifully illustrated volume full of the most varied information. It is much more elaborate than the usual railway guide, for while in the first part the various lines of railway are followed, the topographical

and general information as to each place touched is very full, and in the second part there is a general geographical and economic survey of the country. The various scenes of operations in the South African war receive particular attention. There is a review of railway development. The book, though primarily devoted to Natal, contains much information about the Orange River Colony and Transvaal.

'We Two in West Africa.' By Decima Moore and Major F. G. Guggisberg. (London: Heinemann. 1909. Pp. xvi., 368. *Maps and Illustrations.* 12*s.* 6*d.*) There is something of greater value in this book than might be suggested by the title. In great part it is simply a narrative of experiences, but besides these there is a chapter on the past and future of gold-mining in West Africa, and various other topics of which the authors possess valuable knowledge are touched upon. And the experiences are highly entertaining.

'The Black Bishop.' By Jesse Page. (London: Hodder & Stoughton. 1908. Pp. xv., 440. *Maps and Illustrations.* 7*s.* 6*d.*) This is a life of Bishop Samuel Crowther, of the Niger Territory, a Yoruba by birth. That it is an interesting story need hardly be said. The narrator's style is occasionally florid, but always sincere, and the book throws much light upon the life of the country in which the bishop worked.

America.—'Alaska: the Great Country.' By Ellen Higginson. (London: Bell. 1909. Pp. x., 537. *Map and Illustrations.* 7*s.* 6*d.*) The authoress has travelled extensively in Alaska, and is enthusiastic as to its beauties. Story, history, description, and narrative make up a volume which is something of a patchwork, but always interesting, and contains a good deal of information on the resources of the country.

'Der Panamakanal.' By Dr. Fritz Regel. (Halle: Gebauer-Schwetschke Druckerei. 1909. Pp. 128. *Maps and Illustrations.* 4*m.*) This is vol. 6 of the third series of the 'Angewandte Geographie.' It is a complete treatise on the great canal, compressed into a small compass. There are a notice of the physiography of Central America, a survey of the history of the canal project, and of course full details of the present scheme. There is also a useful bibliography. The illustrations are curiously inappropriate.

'The Story of the Great Lakes.' By Edward Channing and Marion F. Lansing. (New York: Macmillan. 1909. Pp. 398. *Maps and Illustr.* 6*s.* 6*d. net.*) This book is almost entirely historical, and brings out in a vivid manner the important part played by the great lakes in the history of North America. Their exploration, the struggle for their possession, and the history of their development as highways of commerce, are made each the subject of a separate part of the book. There are some small but sufficient sketch-maps, and a bibliography, carefully classified.

General.—'The British Empire.' Edited by A. F. Pollard. (London: League of the Empire. 1909. Pp. xxxi., 864. 5*s. net.*) This is a valuable work of reference, for which there was room. It contains short geographical notices on every part of the empire, but the economical and political aspects are those to which most space is devoted. A lengthy chronological table of the empire will be useful to the historical geographer, and there is a full index.

'Yachting on the Pacific.' By Alexander Mann. (London: Duckworth. 1909. Pp. xi., 286. 6*s.*) This volume gives the story of a venturesome voyage from Guayaquil to the Galapagos islands in a motor schooner, in the course of which the author made some oceanographical observations which are not given here. It also describes journeys in Peru and Ecuador, and has copious notes on the economic resources of those countries.

'The Frontiersman's Pocket Book.' Edited by Roger Pocock. (London: Murray. 1909. Pp. xx., 463. *Illustrations.* 5*s.*) This volume has been

produced on behalf of the Legion of Frontiersmen. Into an extraordinarily small compass it compresses a vast amount of information of value not only to "Frontiersmen," but to any traveller who has to depend upon himself. A section on "means of travel" deals with riding, driving, sailing, and motor boats and cars. Topographical, camping, and medical hints are to be found in other parts of the book.

'Guides-Joanne.' (Paris : Hachette et Cie.) A number of these admirable guides are before us. One series, bound in red, deals, in handy and cheap form, mostly with the neighbourhoods of certain favourite places of resort. Such are 'St. Malo: Dinard' (pp. 12, 63, 160; 1 *fr.*); 'Nantes' (pp. 4, 63, 166; 1 *fr.*), including the lower Loire; 'Cannes' (pp. 28, 69, 156; 1 *fr.*), including Antibes and Grasse: 'Angers' (pp. 32, 160; 50 *centimes*), and 'Réseau P.L.M.' (pp. 4, 268, 160; 4 *fr.*). All these contain the usual excellent maps, and the small volumes have some good illustrations in brown half-tone. In another series we have 'Le Caire et ses Environs' (pp. 182, 160), with maps and many photographs; and lastly an English volume—which, considering the reputation of the French ones among English travellers, should meet a wide demand—namely, 'The Chateaux of the Loire' (pp. vi., 134, 156; 3 *fr.*), which, however, is hardly so well produced as the rest.

THE MONTHLY RECORD.

EUROPE.

Thermal Spring in the Étang de Thau.—In the north-east corner of the Étang de Thau, a lagoon near Cette on the Mediterranean coast of France, there exists between the little towns of Bouziques and Balarac-les-Baines, about 500 feet from the shore, a thermal spring occasioning constant ebullition at the surface of the water. This spring forms the subject of a paper by MM. Chevallier and Gudry, published in the *Bulletin de L'Institut Océanographique* (*Monaco*) for February 25, 1909. It has long been known under different names to local fishermen and studied by other investigators besides the authors of the paper in question. The spring bursts forth at a depth of about 100 feet; at the bottom the column of water escaping from the orifice is very narrow, perhaps only a few square centimetres in section, but it widens with its height, occupying at the surface a circular space of from 25 to 30 feet in diameter. Soundings show that the funnel, composed of calcareous rocks and enclosing the rising column of water, is found at a depth of about 10 feet below the surface, and that at a depth of 100 feet is situated the orifice through which the spring escapes. The temperature of the spring is nearly constant throughout the year and from top to bottom of the column of water, being about 21°·0 C. (69°·8 Fahr.). In winter a fog frequently broods over its site, and when, as occasionally happens, the Étang de Thau freezes, the surface of the water beneath the spring remains open. The high temperature of the spring has a great effect on the fauna of this part of the étang, and many migratory fishes which come from the sea in spring do not return there when the waters of the étang begin to get cold in autumn, but live in the neighbourhood of the spring, thus affording a rich harvest to fishermen. The spring is not fresh water, but owing to its mixing with the surrounding water the exact composition is not easy to ascertain. The density of water, however, is less than that of the lagoon, which is itself less dense than the Mediterranean, with which the lagoon communicates. Violent winds from the north frequently blow across the Étang de Thau. Among the local names of the thermal spring the most generally used is "La Source de la Bise."

The Battle of Thrasymene.—We have received the following communication from Mr. Freshfield: "In August, 1886, in the *Alpine Journal* (vol. **13**, p. 31),

I expressed, in a footnote, my own view as to the site of the Roman defeat at Lake Thrasymene in the following terms: 'Knowing the ground, I have no doubt the battle was fought between Passignano and Torricella. When the new contoured Italian Survey is published, students will be able to see why.' It was therefore with some satisfaction that I read in the last April number of the *Geographical Journal* that this *obiter dictum* had been fully confirmed after thorough investigation by a very capable commission of military experts (see p. 496). I trust that this verdict will be generally accepted. I observe that the note I cite goes on to say that it is in opposition to the German view, which assigns the battle to the lake's northern shore, but in agreement with the English. This is hardly correct, at least as far as the English view is concerned. Dr. Arnold, it is true, in a letter written on the spot, strongly inclined towards the eastern site, but at a later date in his history he hesitated. The late Mr. W. T. Arnold gives a long and careful note to the matter in his edition of his uncle's chapters on 'The Second Punic War,'* but, like his uncle, comes to no definite conclusion. Mr. Bosworth Smith, in his 'Carthage and the Cathaginians,'† adopts, in a summary way, the northern site. But Mr. Bosworth Smith was apt to be offhand, and in my judgment is seldom trustworthy in topographical discussions. Of the Germans, Nissen, Stürenburg, Meyer, Faltin are for the northern site, Niebuhr, followed by Voigt, for the eastern (see 'The Second Punic War,' note E, for full references). 'Historians! Lackaday! If they had ta'en the pains to satisfy their own eyes, instead of following each other's blind guidance!' exclaims Oldbuck in the *Antiquary*; and the student of ancient history may often, while reading the lucubrations of modern critics, be tempted to endorse his protest. I may add that the discrepancies they allege to exist in the classical texts appear to me to be either non-existent or unimportant. One example of perverse misunderstanding may suffice. Mr. Arnold says that Livy's phrase, 'ubi maximè montes Cortonenses Trasumennus subit' ('where Lake Thrasymene comes nearest to the foot of the hills of Cortona'), 'makes it certain' that Livy placed the battle on the northern shore. In my judgment it does nothing of the kind. Livy speaks of 'the hills of Cortona,' not of the city, and it is on the eastern shore that the hills touch the lake most closely."

The Pass of Hannibal.—Mr. Freshfield also writes: "Herr Scheffel has recently issued the first part of a history of the passes of the Alps, which carries their story up to the time of Theodoric the Great.‡ I desire to call attention to what appear to me to be notable omissions in his treatment of the Roman passes of the Western Alps, which invalidate his opinion on a matter which I have been at some pains to investigate—the Pass of Hannibal. In citing authorities, he fails to refer to the very important fragment from Varro, preserved by Servius. In dealing with local and circumstantial evidence, he ignores that for the Col de l'Argentière and the Mont Cenis (or, at any rate, for a pass from Susa to the Arc valley). The latter has recently been strengthened by the discovery of Roman remains at St. Jean de Maurienne. While fully conscious of the difficulty, in the face of the statement made by Sallust that Pompey crossed a different pass from Hannibal, in believing that Hannibal crossed the Mont Genèvre, the only alternative he can suggest is that Hannibal may have crossed the Col de Clapier, or Mont Cenis, and he makes the strange suggestion (p. 21) that these passes might be approached by the Durance valley. I will not repeat here what I have written at length many years ago about Hannibal's pass in the *Alpine Journal* (vols. 11

* Macmillan: 1886. † Longmans & Co.: 1879.

‡ 'Verkehrgeschichte die Alpen,' 1 Band. Berlin: D. Reimer. 1909.

and 13) and the publications of the R.G.S. My belief that he crossed a Durance pass has been accepted by Mr. Coolidge, by Mr. W. T. Arnold, by Mr. G. E. Marindin,* and other writers. My view that he crossed the Col de l'Argentière has been said by Mr. W. T. Arnold to hold the field. I have read sundry dissertations in which my facts and my arguments have been ignored, but none in which they have been discussed from a hostile point of view with anything like an adequate appreciation of the available evidence as a whole. I hope, by calling attention here to their existence, to put Continental and Transatlantic critics in a position to discuss the question with more complete knowledge of the orography and history of the Western Alps. This must not be taken as in any sense a review of the portion of Herr Scheffel's work published, which no doubt will, when complete, be treated as a whole."

The Snow-line in Norway.—A paper, by J. Rekstad, entitled "Die Abhängigkeit der Lage der Schneegrenze von den Sommerisothermen in Norwegen," appears in the *Forhandlinger i Videnskabsselskabet i Christiania* for 1907 (1908). The factors which most influence the position of the snow-limit are, in the first place, summer temperature and the annual quantity of precipitation; in the second place, wind-force and the humidity of the air. It used to be thought that the precipitation quantity had a greater influence than the summer temperature. The lower snow-line in western than central Norway used to be ascribed to the greater precipitation; but this can be equally well explained by the lower summer temperature of the coast. Recent investigations have found that in Switzerland temperature is the outstanding factor. In the Alps the quantity of precipitation has comparatively little influence. In Norway, as in Switzerland, the summer temperature is of more importance than the annual precipitation, both upon the position of the snow-line and the movement of glaciers. The snow-line in general runs parallel to the summer isothermal lines. By the snow-line is meant the climatic limit above which the heat of summer is insufficient to melt the snow which falls upon a horizontal surface in the course of a year. It is to be distinguished from the orographical snow-line, which varies with the exposure and slope of the ground. The climatic snow-line in Norway is approximately defined by the zero C. isotherm of the summer half-year April to September, but lies, on the whole, somewhat lower. The zero isotherm of the summer *six* months April to September lies 420 metres lower than the zero isotherm of the *four* summer months May to August. The latter line coincides well with the climatic snow-line, but lies a little higher along the coast and lower inland. A study of isothermal and isohyetal lines has shown that this—the lower snow-line on the coast—depends upon the summer heat of the four months May to August, and not upon abundance of precipitation on the coast of Norway. It is only during the four warm months May to August that the interior of Norway is warmer than the coast, which is of course much milder on the balance of the year. In low latitudes the reverse is the case, the land, owing to excessive insolation, being warmer than the sea during the larger portion of the year. In Switzerland, where local influences stand out more prominently, the agreement between the summer isotherms and the snow-line is not so good as in Norway.

ASIA.

Dr. Longstaff's Himalayan Expedition.—Letters have been received from Dr. T. G. Longstaff, dated June 11, from the head of the Saltoro valley (Baltistan), where he purposed establishing a base camp for a few weeks to explore the

* *The Classical Review*, June, 1899 and 1901.

Biiafond and Chumik glaciers. He had travelled by the Zogi-la and Ganse-la passes (the latter over 17,000 feet) to Khapalu, where he was informed that formerly there was an old road to Yarkand over the Saltoro glacier and another to Nubra, but that since the English had "got so powerful" every one was able to use the Karakoram route in safety, so the old glacier routes were no longer used. A telegram has since been received (July 12): "Crossed Saltoro [Glacier pass] June 15. Interesting discoveries beyond."

The New Anglo-Siamese Boundary in the Malay Peninsula. — A Parliamentary Paper issued in June (Cd. 4646) prints the text of the treaty of March 10 last between Great Britain and Siam, by which the states of Kelantan, Trengganu, Keda, and Perlis, with the adjacent islands, were transferred by Siam to the British Government (see article in the April number, p. 478). The precise line followed by the new frontier is defined in a protocol annexed to the treaty, and, as regards all but its extreme western portion, is shown in an accompanying map. It has already been shown in the sketch-map given in the April number, which was based on information supplied by the Colonial Office, the only point of difference between this and the map annexed to the treaty being that the part of British territory shown in our map as running north of 6° N., east of the upper Patani river, is in the official map cut off just south of that parallel. In the west the boundary begins from the most seaward point of the northern bank of the estuary of the Perlis river, and thence runs north to the watershed between that river and the Pujo. This watershed is followed until the main watershed of the peninsula is reached, the latter being then followed to the source of the Pergau river (shown on our map just south of Tomo near the north-west point of Kelantan). It then runs between the basins of the Pergau and Telubin rivers (the latter is that entering the sea at Saiburi) to the source of the Golok, which then becomes the frontier until the east coast is reached. Provision is also made for the partition of the islands adjacent to each end of the frontier, the parallel in which the frontier leaves the sea on the west being here the dividing line, while near the mouth of the Golok, Langkawi and the islands to the south become British, Terubau and others to the north remaining Siamese.

The Protected State of Keda, Malay Peninsula.—Since publishing the article on the new British-protected states in the Malay peninsula alluded to in the above note, we have been favoured by the Colonial Office with a copy of a second report on the least-known of the states, that of Keda, which, as stated in our article, had since September, 1905, been under the supervision of a British "adviser." The present report records continued progress towards a successful development of the state, the financial position of which is said to be eminently sound. In the Changlun district a new road will shortly be completed to Perlis, to which state it will for the first time provide access otherwise than by sea, or by elephant through the jungle. This road opens up a large paddy-producing area, while six rubber-planting estates have been recently opened. It is said that the trees are doing well, and that both soil and climate are suitable for their growth. The small Yen district, an exceedingly healthy one, exports large quantities of fruit to Penang. The Kuala Muda district is large, and contains some good tin-land as well as several prosperous plantations, but, as in other parts of the state, roads are the great desideratum. Baling, a town five days' journey up the Muda river, is, however, rapidly springing into importance owing to its proximity to the Rahman mines. The town of Kulin is the centre of the tin-mining industry in Keda, as well as a centre for large Chinese tapioca estates. These last have been conducted on a wasteful scale in the past, and large areas have now been deserted, though some excellent estates remain. The bulk of the

report is taken up with details regarding the administration of the state, into which it is unnecessary to enter.

Trade-routes and Communications in Northern China.—Some interesting data as to the trade-routes in Northern China are given in the Tientsin Trade Report for 1907–08, just issued by the Foreign Office and Board of Trade. The net imports into Tientsin, exceeding as they do those of any other port in China, are conveyed into the interior under transport passes, and subserve the needs of a huge hinterland, including northern Shensi, nearly all Kansu, and even parts of Tibet and Turkestan. In 1908 the value of the goods thus sent into the interior was 66 per cent. of that imported into the whole of China. The export trade of Tientsin is interesting as having been largely built up by the enterprise of British firms, and the greater part of the business is still in British hands. Chinese agents are sent with outward transit passes to the borders of Mongolia, where there are collecting centres, to which supplies of sheep's wool, camel's hair, and skins are brought in by Chinese dealers, who obtain their supplies by bartering with the Mongolians for piece-goods, grain, brick tea, sugar, flour, oil, wine, etc. The chief collecting centres are Pao-t'ou (or Pau-tu, as it is sometimes spelt), on the Yellow river, in Shensi, Kwei-hwa-cheng, and Chang-chia-k'ou, or Kalgan. At one or other of these centres the wool is roughly cleaned and packed up ready for conveyance by camels, carts, and pack-mules as far as Feng-tai, near Peking, whence it comes to Tientsin by train. A diversion of the flow of trade has set in towards Tsing-tau, in the German sphere, this being chiefly in the matter of native produce, medicines figuring as the principal item. Formerly, the entire trade of the northern half of the Honan passed through Tientsin, whereas now less than one-tenth follows that route. Packages of medicines are now sent down the Yellow river as far as Lo-kou, the river port of Chinan-fu, and thence by rail to Kiao-chow and Tsing-tau. So much has the traffic between the Hoang-ho and Chinan-fu increased that the Shang-tung merchants in 1908 insisted on having a short narrow-gauge railway built from Lo-kou to Chinan-fu, so as to connect the Yellow river with the Shang-tung railway, and refused to be content to wait for the completion of the Tientsin-Pukow railway, which will eventually connect Chinan-fu with the river. It is stated that the light railway has been since completed. The Tientsin-Pukow railway will prove a great improvement to the communications of Tientsin in making this town the northern terminus of the long-contemplated trunk-line from the Yang-tze river. The northern section of the line is being built with German capital and the southern section with British capital. With the existing railway from Peking through Tientsin to Mukden, with the line from Peking to Kalgan approaching completion, and with the new line to Pukow, Tientsin will soon boast a position as a railway centre in China second only to that which will be occupied by Hankow when the trunk-lines emerging there are completed.

AFRICA.

Climatic Change in Egypt.—The climate of Egypt, though perhaps it could not be described as interesting in the sense that the climate of England, characterized by almost every conceivable variety and rapid change of weather, is interesting, should perhaps, in virtue of the simpler and more constant state of the weather and seasons, afford more certain or more easily ascertained indications of the existence of any definite climatic change operating through a long series of years. The subject has been dealt with by Mr. B. F. E. Keeling, in the *Cairo Scientific Journal* for January, 1909. There is a widespread belief that, through increased irrigation, Egypt is becoming colder and damper, and Mr. Keeling has endeavoured to show that meteorological records do not support the popular contention. The temperature

records of the Abbassia observatory, where observations have been made since 1869, show no certain indication of any decrease of mean annual temperature, which ranges about 21° C. (69°·8 Fahr.). The relative humidity values likewise indicate no decided change of climate during the last forty years. The driest year was 1892, with 7 mm. of rain (0·03 inch), and the wettest 1904, with 73 mm. (2·9 inches). At Cairo the mean annual rainfall is 30 mm. (1·2 inch), which falls for the most part in occasional showers and drizzles. Heavy rainstorms sometimes occur in Cairo, but in Upper Egypt rain is very rare. Egypt does not appear to be quite out of the region of frost and snow, but these winter phenomena are rare. Thus at Abbassia, since 1880, there have been only three frosts, the severest being −2° C. (30°·4 Fahr.) in 1880, and −4° C. (24°·8 Fahr.) in 1905. Historical records show that frost was not more frequent in the past, and was always sufficiently rare to be worthy of remark. During the winters of 829 and 1010 A.D. ice was reported on the Nile. There appears, however, in spite of the absence of evidence of any progressive change of climate, to be a well-marked periodicity of mean annual temperature shown by the Abbassia records, coinciding with the eleven-year sunspot period—excess of temperature occurring with excess of sunspots. In the hot dry Egyptian climate sunspot influence would probably be less easily masked by other more powerful atmospheric influences than in cold cloudy northern countries. The climate of Egypt is, in fact, more favourable to the study of astronomy than of meteorology.

Cotton-growing in Egypt.—Last year a committee of the Khedivial Agricultural Society at Cairo discussed the alleged deterioration of the cotton crop, but were much hampered by the want of reliable statistics. This spring the Egyptian Government has made use of the maps of the Cadastral Survey (scale 1 : 25,000), in order to verify the whole area planted with cotton in Egypt. The whole staff of the Cadastral Survey was employed for six weeks in marking on the maps the plots on which cotton had been sown, and from these the areas were subsequently taken. These amounted to 1,466,530 feddans, or 1,522,258 acres. Since the land-tax has been recently reassessed on the basis of the same maps, it will be easy to ascertain also the areas planted with cotton on land of different grades of fertility. This work will form a reliable basis for agricultural statistics, and, if repeated in subsequent years, will indicate whether there is a tendency to extend the cultivation of cotton on to low-grade lands.

A Tour through the Eastern Province of Uganda is described by the Governor of the Protectorate in a recent Colonial Report (Miscellaneous, No. 57). The first 20 miles lay through land infested by the "mbwa fly," which forbids the tillage of hundreds of square miles in Busoga. The abundance of "mvuli" trees around Iganga (23 miles from Jinja) calls for the erection of a saw mill, whence lumber might be easily transported to Jinja. In reference to a solitary European's plantation near Kilele, the writer sounds a note of warning against too isolated enterprise, and points out the economic and social advantages of more compact communities. The Mpologoma river dividing Busoga from Bukedi was found, when crossed in dug-outs, to be 1½ mile wide and 7 feet deep. If cleared of papyrus the river would afford a waterway for the transport, to Lake Kioga and the projected Victoria-Kioga railway, of the produce which at present goes overland to Jinja. A pontoon ferry-boat is approaching completion. Arrived in Bukedi, the party enjoyed the prospect of a vast level expanse of very fertile soil, almost free from elephant grass and papyrus swamps. The Bakedi, though naked, are a moral people, of shapely build and happy temperament, who greeted the governor's party with spontaneous cries of "Yoga! yog.!" Both men and women take their share of labour in the fields. They have (without payment) laid down some

350 miles of broad smooth highway, bordered by shade trees, and kept in excellent repair, so that, save in very wet weather, a motor-car might travel at high speed all over the land. It is to be regretted that, with the facilities for trade now being introduced, this willingness to give their time freely for the service of the state is likely to lessen yearly. The Baghishu district, on the slopes of Mount Elgon, surprised the governor by the extraordinary density of its population, and the closeness with which it is cultivated. Yet, in spite of their neat huts, clean courtyards, and well-filled granaries, the people are described as a wild and primitive race, entirely without organization, every man's hand being against his neighbour.

Ethnographical Researches in the Kasai District.—Writing from Alela, a few hours' journey west of the Kamcha river, on April 10, Mr. E. Torday sends us some particulars of the ethnographical expedition in which he has been engaged, in company with Mr. W. Hilton-Simpson, since the autumn of 1907. Entering the region by the mouth of the Congo river, the expedition began its serious work at Batempa, a village on the Sankuru tributary of the Kasai, a short distance above Lusambo. The Batetela tribes between the Sankuru and the Lubefu, a right-bank tributary of the Sankuru, were visited with satisfactory results, and early in March of last year the expedition descended the Sankuru and traversed the country between that river and the Lubudi, a left-bank tributary, obtaining interesting ethnographical collections among the Bangongo, a sub-tribe of the Bakuba. As a result of his investigations among the Batetela of the Lubefu country, Mr. Torday determined to visit the other Batetela tribes inhabiting the forest country north of the Lukenie, and accordingly in May of last year he and Mr. Hilton-Simpson interrupted their work among the Bakuba, and journeyed *viâ* Bena-Dibele into the country north of the Sankuru, where four months were spent wandering in the forest between that river and the Lomela river, the real name of which Mr. Torday says is Dombempila. The climatic conditions were most unhealthy, and though Mr. Torday suffered no serious ill effects at the time, Mr. Hilton-Simpson nearly succumbed to a bad attack of fever. After returning to the Sankuru the explorers visited the Mushenge (capital) of the paramount chief of the Bakuba, which was made the headquarters of the expedition until the end of last year. Here Mr. Torday's health broke down under the strain of continued privations, but his exertions were rewarded by the best ethnographical collection he had so far obtained. Every assistance was given to the expedition by the head chief, whom Mr. Torday describes as a most friendly and intelligent native gentleman. The explorers' stay among the Bakuba showed that the ancient culture of that people had been greatly influenced from the west, and with the object of gaining information on the subject the explorers decided to descend the Sankuru and the Kasai, and then to ascend the Kwilu river to Kikwit, and attempt to reach the Kasai in the direction of Luebo by an overland journey. This overland journey was in progress at the date of Mr. Torday's letter, but he was very doubtful whether they would be able to reach the Kasai owing to the reputation for hostility to Europeans of the tribes inhabiting the country between the Loange and the Kasai, which still figures on the maps as unexplored. Throughout the expedition Mr. Torday and Mr. Hilton-Simpson have refrained from employing any armed followers, the establishment of friendly relations with the natives being essential to the pursuit of their investigations. Besides their ethnographical collections, which have been obtained for the British Museum, they have taken a large number of photographs, including several illustrating the geographical characteristics of the country. The expedition is expected back in England at the end of this year.

Vegetation Regions of Africa.—The African continent has frequently been divided up by geographers into vegetational regions, according to the plant

associations most characteristic of its several parts. The latest and most elaborate attempt to define such a series of regions is that of Prof. Engler, whose life-long study of African botany qualifies him for the task in an unusual degree (*Sitzungsb. der K. Preuss. Akad. der Wissenschaften*, 1908, Nos. 37–38). While others have been content to lay down the broad subdivisions, such as forests, savannahs, steppes, deserts, and the various forms intermediate between these, Prof. Engler carries the process into far greater detail, each large topographical entity being again and again subdivided according to the more special features of its vegetation. The difficulties in the way of such a minute division are of course great, and Prof. Engler recognizes that the scheme is to be regarded as provisional only. But although some may think that the subdivision may have been carried to somewhat excessive lengths, he is no doubt justified in holding that some such attempt is needed to bring out the features of plant-distribution in Africa in their dependence on present and past physical conditions. A special difficulty, Prof. Engler points out, is offered by the coast districts, for though fairly similar features are to be traced throughout long stretches of coast, some connection with successive interior districts is effected by means of river-courses, and this would be lost sight of were the coast-tracts to be treated as indivisible units. Natural districts corresponding to river-basins or mountain systems have therefore been as a rule adopted as the smallest units, and these can be combined eventually as the progress of investigation demands. Prof. Engler adopts the four primary divisions of (1) the Mediterranean region; (2) the North African and Indian desert region; (3) the African forest and steppe region; (4) the region of South-West Cape Colony. The second and third of these naturally cover the greater part of the continent between them, and they are in turn subdivided into provinces, sub-provinces or zones, and districts. In the case of the second region, the criteria for the division into provinces hardly seem so palpable as in the third, which includes the four well-marked provinces of (*a*) the park-and-steppe country of the Sudan; (*b*) the North-East African uplands and steppes; (*c*) the West African and Guinea forests; (*d*) the East and South African forests and steppes. The partition-line between the second and third regions runs so as to include within the former the transition regions south of the Sahara, such as Kanem, Wadai, and parts of Bagirmi and Darfur. The strip of elevated country between the Nile and the Red sea is, however, included in the third region.

AMERICA.

The Climate of the Orinoco and Rio Negro.—In a paper on the region of the Orinoco and Rio Negro, printed in the *Zeitschrift der Gesellschaft für Erdkunde zu Berlin* (1909, No. 2), Herr A. Jahn gives, *inter alia*, the results of observations carried out by himself as regards the climatology of the region. The mean temperature for the year 1887, at Ciudad Bolivar, on the Orinoco river in the lower part of its course, was 83°·1 Fahr. There is a decided decrease of temperature towards the Atabapo and Rio Negro rivers on the borders of Venezuela and Brazil, partly referable to abundance of wood and moisture and excessive cloudiness. The humidity of the air is especially great in the neighbourhood of the Yavita water-parting between the Atabapo and Rio Negro rivers, where at Pimichin the sky is nearly always clouded, and where it rains even during the Venezuelan "verano," *i.e.* during the dry season between January and April. Here it rains almost the whole year round (December and January excepted), and even in the dry season one seldom sees blue sky for more than two or three days in succession. Over the upper Rio Negro, above Marabitanos, the regular tropical dry season disappears, and there is a perpetual alternation of sunshine and shower even during the height of the Amazon summer, from June to September. Over the Orinoco the

case is different. The course of this river runs through a steppe region with wooded margins — a character which sufficiently explains the smaller precipitation and lower humidity as indicated by psychrometer observations made in 1887. The lower course of the river belongs, from a general as well as from a geological point of view, to the Llanos region, and in common with it has its rainy season extending from May to December. During March and April, when the dry season of the Llanos has reached its height, the greatest precipitation occurs over the lower Amazon south of the equator. Then the Llanos exert an aspirating effect, drawing the saturated and cooler air of the Amazon towards the north, whereby the moisture is precipitated on the elevated watershed which forms the boundary between Venezuela and Brazil.

A Lady's Ascent of Mt. Huascarán, Peru.—Miss A. S. Peck, an American lady mountaineer, who has devoted herself for some years past to travel and ascents in the Andes, last year succeeded in reaching the summit of the previously unconquered peak of Huascarán, in Peru. This peak, the ascent of which was attempted (unsuccessfully) many years ago by Raimondi, and more recently by Mr. C. R. Enock (cf. *Journal*, vol. 25, p. 627), is generally estimated at a little over 22,000 feet,* or some hundreds of feet lower than Aconcagua. Miss Peck, whose account of her ascent appears in the June number of the *Bulletin* of the American Geographical Society, considers that its height is about 24,000, and that it is thus the highest summit in the Andes; but as no point higher than 19,600 feet was determined instrumentally, the extent of the further climb being merely estimated, this claim must at present be received with reserve. Miss Peck had made two previous attempts on the mountain, in 1904 and 1906, being then accompanied by natives only. In 1908 she had the assistance of two Swiss guides from Zermatt, Gabriel and Rudolf Taugwalder. A first attempt on the north peak of the mountain proved unsuccessful (one of the guides being forced by an attack of mountain sickness to return). On a subsequent occasion, both guides taking part, better progress was made, the previous fourth snow-camp being almost reached by one day's climb above the snow-line. The top of the saddle connecting the two peaks (altitude 19,600 feet) was reached on the second evening, an excessively steep wall of ice having been surmounted during the day. On the third day the actual summit was reached, though both Miss Peck and the two guides suffered severely from cold and fatigue, one of the latter being badly frost-bitten. An attempt to ascertain the altitude by hypsometer had to be abandoned, the wind making it impossible to light the candle. The descent proved more difficult than the ascent.

The Distribution of Population in Bolivia is the subject of an article by Prof. I. Bowman in the *Bulletin of the Geographical Society of Philadelphia* (vol. 7, No. 2). Covering a sixth of the area of the United States, Bolivia, in point of population, falls short of Iowa, which has but one twenty-sixth of its area. Only 3·1 per square mile, its population is most unequally distributed. Avoiding the malarial plains with their unnavigable rivers, the bulk of the population cleaves to the stupendous mountains of the west, filling about one-third of Bolivia. Of this "roof of the Western world," an uppermost stratum of bleak or snow-covered mountains, 7 per cent of Bolivia's area, is uninhabitable. Above 13,000 feet population is exceedingly sparse, tempted thither only by the mines or pastures. Yet temporary habitations are found at 15,000 feet or higher. Between the east and west Cordilleras, again, lies an enclosed basin of less elevation, the "alti-plano" or "planicie," containing the great salars of Coipasa and Uyuni, equally bleak and

* Mr. Enock, in his book on Peru, says that it has been "calculated by triangulation as 22,180 feet."

uninhabitable. Comparative lack of fuel, six weeks' cold in June and July, and attenuated atmosphere, constitute conditions of life at high altitudes only moderately better than those on the hot plains. The choicest situations in respect of climate, fuel, health, and fertility are the intermediate levels of the eastern slope. The most densely populated province, accordingly, is Cercado (8400 feet). Besides climate, however, distribution of natural resources, accessibility to trade routes, and convenience of communication are factors influencing distribution of population. Of the nine most populated provinces, five, accordingly, stand at over 11,000 feet; the mines of Oruro, Huynuni, and Potosi more than outweighing conditions of habitation otherwise so unfavourable. The 151 most important towns of Bolivia are perched at an average elevation of 8900 feet. The relation between altitude and population is illustrated by a series of maps.

POLAR REGIONS.

Dr. Bruce's New Expedition to Spitsbergen started during July on board the steam-trawler *Conqueror* to continue the leader's researches on Prince Charles Foreland and adjacent districts. The party includes several experts, who will carry out topographical, geological, and other work, among them being Mr. Rudmose Brown, formerly of the Scottish Antarctic Expedition, and now Lecturer in Geography at Sheffield University.

Swedish Explorations in Spitsbergen.—The publication of a synoptical record of these explorations, reprinted from *Ymer*, part i., 1909, is welcome as supplying an historical view of Sweden's important share in the scientific elucidation of that region, to which attention is at present called by the action of Norway in inviting the other Powers interested to a conference on the political status of the group. The first entry, that of 1758, records the naturalist A. R. Martin's voyage, undertaken at the request of Linnæus. The harvest of this three months' trip, which attained the 80th parallel, is summed up in meteorological observations published in the *Transactions of the Academy of Sciences*, and in zoological observations in Martin's narrative. A gap of seventy-nine years divides this tentative enterprise from the next Swedish voyage in 1837, under Sven Lovén, which, carried out at his own expense, brought home zoological and geological observations and collections. Under its impulse Torell made a short expedition in 1858, which sighted most of the fiords on the western coast, and the great expedition of 1861, which was commissioned to determine the question of the feasibility of measuring an arc of meridian, and which, besides, explored the northern and western coasts. Thus was Sweden definitely committed to the mission of Arctic exploration, and henceforth Swedish expeditions follow one another in close succession. Altogether from 1832 to 1908 there were twenty-five Swedish expeditions to the Spitsbergen region. There is an excellent bibliography and a list of maps which give full and detailed information on works in Swedish and other languages.

New Details regarding a Franklin Search Expedition.—Of the many expeditions, by sea and land, which took part in the search for Sir John Franklin, one, of the details of which not much has been generally known, was that of Messrs. Anderson and Stewart, despatched by the Hudson Bay Co. in 1855 down the Great Fish river to endeavour to obtain more precise information respecting the fate of the lost explorers than had been obtained by Dr. Rae. Some facts regarding this expedition have lately been ascertained by Mr. J. B. Tyrrell (well known for his own explorations in the Barren Grounds and elsewhere), who read a paper on the subject before the Canadian Institute in December last (*Trans. Canadian Inst.*, 1908–9, pp. 393–402). The expedition returned unsuccessful, having found no records or remains of any of the missing men, though it did reach to within

a very few miles of Starvation Cove; the absence of an interpreter unfortunately making it impossible to extract any information of importance from the Eskimo. In 1890 Mr. Tyrrell received from a French Canadian named Boucher, who had been cook on the Expedition, a statement to the effect (among other details) that three men, sent northward beyond Montreal or Maconochie island, did see one of the ships far out in the ice, but concealed their discovery for fear of disaster in case of an attempt to reach it. Mr. Tyrrell has since succeeded in obtaining statements from the three men, two of whom were Ojibway Indians, while the third was a half-breed. It seems that the party (which consisted of four in all) separated, and that one only professed to have seen the ship; but that he did so at the time is confirmed by one, at least, of his companions. The discovery of a broken boat on the east side of Montreal island is also mentioned. Mr. Tyrrell thinks that the tale cannot entirely be set aside, and that the ship which finally sank at Ut-lu-lik may have previously drifted into Simpson strait and back.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Dr. Nansen's Investigations in the Northern Atlantic.—Dr. Nansen has informed us, under date July 11, that the preparations for his new cruise in the Northern Atlantic were then almost complete. The yacht in which the cruise was to be made had been specially strengthened and fitted out for oceanographical work, while the steam-engine had been replaced by a motor-engine. Owing to unavoidable delays, he would be able to carry out only a part of his programme; but he hoped first of all to carry out investigations of the Gulf Stream, and afterwards, if possible, to extend his researches to the Polar current, near the east coast of Greenland.

The Percy Sladen Trust Expedition to the Indian Ocean.—Mr. J. S. Gardiner announced in *Nature* for May 13 the completion of the field-work of this expedition (cf. *Journal*, vol. 33, p. 214), Messrs. H. Scott and J. C. F. Fryer having returned from the Seychelles and Aldabra on March 29 last. Mr. Fryer's preliminary report on his five months' work on Aldabra is of much interest in reference to the configuration and physical history of the island, which has been generally considered to be a typical atoll. A discovery of particular importance is that of rocks of apparently volcanic origin, and it is hoped that their study may furnish a clue to the nature of the base on which Aldabra is built.

The "Ornithias" of the Greeks.—Unusual obscurity has, down to recent times, shrouded the question of the Ornithias of the Greeks—the wind prevailing at the time of the spring migration of birds. While Democritus, Hippocrates, Aristophanes, and many others took the north wind for the Ornithias, Aristotle recognises it in the south wind, whereas Pliny defines it as the west, and Vitruvius as the east wind. The attempt made by Beler, in his 'Meteorologia Veterum,' at a philosophical solution of these contradictions was therefore bound to miscarry, and strict observation of Nature could alone supply the proper clue. In an appreciative review of Demetrius Æginetes' great work on the climate of Greece (*Göttingische Gelehrte Anzeigen*, Berlin, 1909, No. 4), Joseph Partsch takes occasion to elucidate the past and present position of the Ornithias problem. Following up the immediate observations of ornithological authorities, such as C. L. Brehm, F. F. Naumann, and others, he adopted, as the basis of a true solution, their declaration that "birds like best to fly not with but against the wind." In his 'Physikalische Geographie von Griechenlund" (1885), he had consequently no alternative but to conclude in favour of the north wind. The great work of the Archduke Ludwig Salvator on Zante (1904) was the first to suggest another train of thought. This well-known student of the Mediterranean world enters at large

into a description of the weather conditions of the so-called Trygonokairos (or turtle-dove weather). The result is to show that in any case it is the south winds during which the landing of birds of passage is to be looked for. When, to the chagrin of hunters, the south wind is persistent, the birds pass lightly on without stopping, and only in case the wind veers suddenly to the north do they make any serious halt. Similar observations have been made by Dr. Parrot on the Taygetos in the Peloponnese. These facts at once explain the main contradictions in the statements of the ancients. South winds favour the passage of the birds from Africa to Greece. For Aristotle and others the south wind is therefore the ornithias. The north winds, on the other hand, by holding up the flight of birds, render them an object for the hunter's aim. Others would therefore recognize the Ornithias in the north wind. The accounts of east and west Ornithiai occur not in Greek, but solely in Roman writers, and can therefore be easily explained by geographical considerations. Only in respect of the character of the south Ornithias is there a contradiction still calling for solution. According to the Archduke, the bird-bringing south wind is evidently represented by the moist, warm, and hazy sirocco of the Ionian sea. The ancients, on the other hand, describe the same wind as one that sweeps the sky clear of clouds. An explanation of this contradiction may be hoped for from the future volumes of Æginetes' work. This new interpretation is in accord with the theory of the flight of birds as developed by instantaneous photography and cinematographic records in the course of the last two decades. *Flight* of birds is now distinguished from their soaring motion. Birds do, in fact, fly against the wind, but only in rising from the ground. To keep up a flight straight in the teeth of the wind is more than their powers are equal to. As Aristotle says, such a wind "disperses the flocks of birds over the land."

Marsh Vegetation and Evaporation.—Prof. R. H. Yapp, University College of Wales, Aberystwyth, publishes in the *Annals of Botany*, vol. **23**, No. 90, April, 1909, the results of several years' study of marsh vegetation in connection with its structure in relation to conditions of evaporation and temperature. The primary object of his researches is to throw light on the problem of swamp "xerophytes," and the paper in question, describing the structure of the vegetation of a marsh, discusses more particularly the relations of the aërial shoots to one another, as well as to the external factors which directly influence transpiration. Respecting the vertical distribution of the transpiring organs of the different species, the plants are grouped into some five "ecological" types, which depend to a large extent on the relative positions on the stem of the larger leaves. From this difference of ecological habit there results a marked stratification of the vegetation, varying in height from 2 to 5 feet. The layers or strata, which are exhibited in the subterranean parts as well as in the aërial shoots, merge into one another more, and are therefore less distinct, than the obvious vegetational strata of a forest. Field observations upon evaporation and temperature were made at Wicken fen in Cambridgeshire, during the summers of 1908 and 1909. A specially constructed type of evaporimeter, suitable for biological purposes, was used. It consists essentially of a porous earthenware cylinder filled with distilled water, and the water percolating through the pores of the earthenware evaporates from its surface, the water-loss being measurable to a single drop, *i.e.* to about 0·05 cub. cm. Three of the instruments, together with thermometers fastened to a stand, were placed at different levels—one above the general vegetation level, another about the middle of the vegetation, and another a few inches above the ground at the bottom of the vegetation. The experiments showed (1) that the air among the vegetation is, on the whole, much more humid than that outside, the lower strata being also much more humid than the upper even with herbage only 2 feet in height;

(2) that transpiration conditions at or just below the general vegetation level are little more than half as severe as those which exist at a level well above it; (3) that—a fact not easy to explain—in the highest layers of the vegetation the diurnal range of temperature is greater than either in the free air above or in the lower layers of the vegetation. As regards the temperature observations, Prof. Yapp adopted the highly commendable practice of using thermometers with their bulbs freely exposed to sun and wind. From the point of view of vegetation, the temperature in the sun is of more importance than the shade temperature. The great majority of the shoots of the different species of marsh vegetation attain to very much the same height, thus giving rise to a fairly uniform "general vegetation or shoot level." This close proximity of shoots to one another, not only in marsh plants, but in vegetation in general, affords protection to the plants against excessive transpiration and the mechanical effects of wind. When external conditions are severe, as in the case of desert shrubs and wind-swept trees by the seashore, the contours produced by this association of shoots are often very regular.

GENERAL.

The Research Department, 1908-9.—During the Session now ending five papers have been read before the Research Department of the Society. Of these, two were mainly concerned with meteorological phenomena, namely, a consideration of the "Distribution of Rainfall in Wales," by Mr. Williams, and of the "Isohyets 'twixt the Sahara and the Western Sudan," by Mr. Alexander Knox. The data were arrived at in different ways; in the former by direct determination of the rainfall by gauges, in the latter by inference from the character of the vegetation. In both due consideration was given to the connection between rainfall and geographical features. In another paper, Mr. Alfred H. Harrison submitted a scheme for a sledge expedition across the North Polar area, which was adversely criticized. In his lecture on the Systematic Description of Land Forms Prof. W. M. Davis gave an admirable illustration of his method of systematizing not only the nomenclature, but our conceptions of the character and origin of certain physical features of the land. The examples selected lie chiefly on the coast of Italy, but the general principles involved are applicable all over the world. Two communications involving original research were made to the department, namely, an account of observations made on dew-ponds by Mr. E. A. Martin, and a report of progress on the investigation of rivers by a committee consisting of Dr. Strahan, Dr. Mill, Dr. Herbertson, and Mr. Mackenzie. These investigations are being carried on by aid of Government grants (aided in the latter case by a grant from this Society), and are both still in progress. All these papers have led to useful and interesting discussions, but whether full advantage is taken of the facilities offered by the Society in its Research Department, both for carrying on and recording the results of original research, is open to question. One important investigation, of which the results have not been laid before the Department, is proceeding, namely, that upon the character of our coast, and its history as regards loss and gain, change of level, etc. But there are other subjects which would repay attention, and among them may be mentioned the changes effected by rivers during historic times in the position and form of their beds, change of level of the land now in progress from various causes, and the history of the names of fields, when these are of ancient date.

The Eleventh International Geological Congress.—Some of the preliminary arrangements for this Congress, which is to meet next year at Stockholm, were referred to in the *Journal* for December last (p. 627). A further announcement, dated May, 1909, has since been received. As already stated, it is proposed to submit for discussion by the Congress certain broad questions capable of being

illustrated by the study of Swedish geology. Among those already decided on are (1) the geology of the Archæan formations; (2) changes of climate since the maximum of the last glaciation; (3) the extent and distribution of the World's iron-ore deposits. In addition to these, the subject chosen for study under the heading of regional geology is the geology of the Polar Regions, to which the contributions of Swedish scientists have been of so much importance, and of which some view will be given to members by an excursion to Spitsbergen. The approximate date at which the Congress will be opened at Stockholm is August 18, 1910; but as many of the excursions will be to the far north (those in Sweden will cover 13° of latitude), these will take place before the actual session, beginning about July 25. Lesser excursions will be arranged for during the session, while others, to the south of Sweden, will take place still later, concluding about September 16.

OBITUARY.

The Marquess of Ripon, K.G., G.C.S.I., F.R.S.

The death of the Marquess of Ripon removes from the membership of the Society not only a Fellow of very old standing, but a distinguished statesman, who for a brief period in the early part of his career filled the office of President. His father, the first Earl of Ripon, was the first President of the Society, being elected to that position in 1831 while still Viscount Goderich, and while holding office in the Government of the day as Secretary for the Colonies. The late Marquess was born on October 24, 1827. For several years he represented in the House of Commons first Huddersfield and then the West Riding of Yorkshire, until early in 1859 the death of his father gave him a seat in the House of Lords. At the annual meeting of the Society in that year he was elected President, having already for six years been a Fellow of the Society. Later in the year he succeeded his uncle as Earl De Grey, and took the double title of Earl De Grey and Ripon. This circumstance, combined with his appointment as Under-Secretary of State for War in Lord Palmerston's second administration, prevented him from giving that full attention to the affairs of the Society which he had hoped to give. He presided over several of the Society's meetings, including that at which Burton and Speke gave an account of their expedition to the great African lakes, but felt obliged to resign office at the annual meeting in 1860. During his year of office, Speke sailed with Grant on his second expedition for the discovery of the Nile sources, and it was after the late Marquess that Speke gave the name of Ripon falls to the falls at the outlet of the Nile from the Victoria Nyanza. During his Presidency was also initiated Mr. Frank Gregory's expedition for the exploration of Western Australia, and De Grey river was named after the late Marquess. This is not the place in which to discuss in detail his later career. After occupying several Government offices, he served as President of the Joint Commission which arranged the terms of the Treaty of Washington at a time when the relations between this country and the United States were greatly strained over the *Alabama* question, and in recognition of his services in that capacity he was created first Marquess of Ripon in 1871. His acceptance of the Roman Catholic faith led to his withdrawal from public life for several years, but in 1880 he was appointed Viceroy of India in succession to the Earl of Lytton, and subsequently held office as First Lord of the Admiralty in 1886, Secretary of State for the Colonies in 1892–95, and Lord Privy Seal under the present administration. Advancing years led to his retirement in October last, and he died suddenly from heart failure on July 9, a few months before attaining his eighty-second birthday.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1908–1909.

Special Meeting in the Royal Albert Hall, June 28, 1909.—Major LEONARD DARWIN, President, in the Chair.

ELECTIONS.—*Thomas Counsell; Andrew Currie; Samuel Dickinson; W. H. P. Elkins; F. G. J. Eckstein; Edward George Hodgkinson; Robert Harman Mackenzie; Harold Nelson; Sir Frederick Pollock, Bart.; Arthur Warwick Sutton, J.P.; William Augustus Tennant; Robert Anthony H. Claud Thirkell; Sir Capel Charles Wolseley, Bart.*

Lecture by Lieut. E. H. Shackleton :—

"Exploration in the South Polar Region."

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full :—

A. = Academy, Académie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Communications. **Scheffel.**

Verkehrsgeschichte der Alpen. I. Band: Bis zum Ende des Ostgotenreiches Theodorichs des Grossen. Von P. H. Scheffel. Berlin: D. Reimer, 1908. Size 10 × 7½, pp. viii. and 206. *Price* 8*s.*

The first part of an extensive work on the history of communications in and across the Alps, which seems to have been compiled with great thoroughness.

Denmark—Iceland. **Thoroddsen.**

Lysing Islands. Eftir Torvald Thoroddsen. [The physical geography of Iceland, by Thorvald Thoroddsen.] Vol. 1 and vol. 2, part i. Copenhagen: S. L. Möller, 1907–09. Size 9 × 6, pp. (vol. 1) vi. and 368; (vol. 2, part i.) 1–240. *Sketch-maps and Illustrations. Presented by the Author.*

Europe—Ethnology. **Sergi.**

G. Sergi. Europa: l'origine dei popoli europei e loro relazioni coi popoli d'Africa, d'Asia e d'Oceania. Milan, etc.: Fratelli Bocca, 1908. Size 9½ × 6½, pp. xxii. and 652. *Sketch-maps and Illustrations. Price* 20 *lire.*

France—Alpes-Maritimes. **Joanne.**

Collection des guides Joanne. Cannes, Grasse, Juan-les-Pins, Antibes. Paris: Hachette & Cie., 1908. Size 6½ × 4, pp. 70. *Maps, Plans, and Illustrations. Price* 1 *fr. Presented by the Publishers.*

France—Alpes-Maritimes. **Sion**

Jules Sion. Le Var supérieur: étude de géographie physique. Paris: A. Colin, [1909]. Size 9½ × 6, pp. 98. *Illustrations. Price* 3 *fr. Presented by the Publisher.*

France—Guides. **Joanne.**

Collection des guides Joanne. Réseau Paris-Lyon-Méditerranée. Par P. Joanne. Paris: Hachette & Cie., 1908. Size 6½ × 4, pp. 108 and 268. *Maps and Plans. Price* 4 *fr. Presented by the Publishers.*

France—Ille-et-Vilaine. **Joanne.**

Collection des guides Joanne. Saint-Malo, Dinard et leurs environs. Paris: Hachette & Cie., 1908. Size 6½ × 4, pp. 64. *Maps, Plans, and Illustrations. Price* 1 *fr. Presented by the Publishers.*

France—Regional Geography. **Févre and Hauser.**

Régions et pays de France. Par Joseph Févre et Henri Hauser. (Bibliothèque d'Histoire Contemporaine.) Paris: F. Alcan, 1909. Size 9 × 5½, pp. 11 and 516. *Sketch-maps and Illustrations. Price* 7 *fr. Presented by the Publisher.*

France—Western. **Joanne.**

Collection des guides Joanne. La Loire (pp. xii. and 396). Angers et ses environs (pp. 32). Nantes et les plages de la Loire-inférieure (pp. 64). Saint-Malo, Dinard, et leurs environs (pp. 64). Paris: Hachette & Cie., 1908–9. Size 6½ × 4. *Maps, Plans, and Illustrations. Presented by the Publishers.*

Greece—Leukas. **Ludwig Salvator.**

Anmerkungen über Leukas. [By the Archduke Ludwig Salvator.] Prague: H. Mercy Sohn, 1908. Size 12½ × 10, pp. viii. and 62. *Illustrations. Presented by the Author.*

A general description, with special reference to the people and productions.

Italy—Historical. **Pais.**

Ettore Pais. Ricerche storiche e geografiche sull' Italia antica. Turin: Società Tipografico-Editrice Nazionale, 1908. Size 9 × 5½, pp. viii. and 690. *Price* 10 *lire.*

A collection of memoirs, some reprinted (with modifications) from various learned publications. An English edition of a portion of the book was previously issued by the University of Chicago Press.

Italy—Venetia. *Scritti minori di G. Marinelli* (1908): vol. 1, 449–569. **Marinelli.**

Introduzione ad un saggio di cartografia della regione veneta. Di G. Marinelli. Venezia nella storia della geografia cartografica ed esploratrice. (By the same.)

These papers originally appeared some years ago, but are only now made easily accessible by reprints.

Portugal. **Various authors.**

Exposição Nacional do Rio de Janeiro em 1908: Secção Portuguesa. Notas sobre Portugal. Vol. 1. Lisbon: Imprenza Nacional, 1908. Size 10½ × 7, pp. viii. and 814. *Maps, Illustrations, and Diagrams. Presented by Sir C. R. Markham.*

Opens with an excellent geographical introduction, by Prof. Silva Telles, of which a separate reprint has also been received.

Russia—Finland. **Gebhard.**

Société de Géographie de Finlande. Atlas de statistique sociale sur les communes rurales de Finlande en 1901. Par Hannes Gebhard. [In Finnish, French, and Swedish; Explanatory text in *Fennia* **24** (1908): No. 1, pp. 32.] Helsingfors, 1908. Size 13½ × 9½. 55 *Plates. Presented by the Geographical Society of Finland.*

This atlas embodies the results of investigations made by the "Sub-Committee for Interior Colonization," the third volume of whose reports is noticed below.

Russia—Finland. **Gebhard.**

Subkomitén för den Obesuttna Befolkningen. Statistisk undersökning af social-ekonomiska förhållanden i Finlands landskommuner år 1901. III. Den odlade jordarealen och dess fördelning. Af Hannes Gebhard. Helsingfors, 1908. Size 10½ × 7½, pp. xii., 134, and 374. *Presented by the Geographical Society of Finland.*

Part iii. of a general report on the economic conditions of the rural communes. It treats of the area and distribution of cultivated lands.

Scandinavia—Relief. *Ymer* **28** (1908): 141–191, 254–300. **Wråk.**

Bidrag till Skandinaviens reliefkronologi. Av Walter Wråk. *Maps, Illustrations, and Sections.*

Spain. **Calvert.**

Royal palaces of Spain: A historical and descriptive account of the seven principal palaces of the Spanish Kings. By Albert. F. Calvert. London: J. Lane, 1909. Size 7½ × 5, pp. xiv. and 108. *Illustrations. Price* 3*s.* 6*d. net. Presented by the Publisher.*

Spain—Jaen. *Z. Ges. E. Berlin* (1908): 625–631. **Quelle.**

Zur Geologie und Geographie der spanischen Provinz Jaen. Dr. O. Quelle.

Spain—Meteorology.

Resumen de las observaciones meteorológicas efectuadas en la peninsula y algunas de sus islas adyacentes durante el año 1907, ordenado y publicado por el Instituto Central Meteorológico. Madrid, 1908. Size 8½ × 6, pp. viii. and 172. *Index-map.*

Sweden—Agriculture. **Flack and others.**

Sveriges Jordbruk vid 1900 Talets Början. Statistiskt Kartverk, utarbetadt af Wilhelm Flach, H. Juhlin Dannfelt, Gustav Sundbärg. L'agriculture en Suède au Commencement du XX^{ème} Siècle. Göteborg, 1909. Size 19½ × 12, pp. 262. *Maps and Diagrams. Presented by the Librarian, Royal University of Upsala.*

An excellent series of maps illustrates the various distributions bearing on the subject.

Sweden—Gothland. *Ymer* **28** (1908): 240–253, 413–419. **Geer and Stolpe.**

Befolkningens fördelning på Gothland. Af Sten De Geer. *Map.*
Till frågan om Gottlands befolkningsfördelning. Af Per Stolpe.

Discussions of the distribution of population on the island.

United Kingdom. **Mantoux.**

A travers l'Angleterre contemporaine. Par Paul Mantoux. Paris: F. Alcan, 1909. Size 7 × 4½, pp. xiv. and 284. *Price* 3 *fr.* 50. *Presented by the Publisher.*

Impressions on recent political and industrial developments.

United Kingdom—Cathedrals. **Clougher.**

The Cathedrals of England and Wales. By Nugent M. Clougher. (2 vols. in 1.) London: Gowans & Gray, 1909. Size 6 × 4, pp. (vol. 1) 64; (vol. 2) 72. *Illustrations. Price* 1*s.* 6*d. net. Presented by the Author.*

A series of attractive photographs, with brief descriptions of the Cathedrals.

United Kingdom—Coasts. *Geol. Mag. Dec.* V., **8** (1909): 49–56, 113–119. **Whitaker.**

On the Geologic Conditions affecting the Coasts of England and Wales, with special reference to the Coast-line from Lynn to Wells (Norfolk), and from Yarmouth to Eastbourne (Suffolk, Essex, Kent, and Sussex). By W. Whitaker.

United Kingdom—Eastern Counties. **Dutt.**

Cambridge County Geographies. (Edited by F. H. H. Guillemard.) Norfolk. By W. A. Dutt. (Pp. viii. and 156.) Suffolk. By the same. (Pp. viii. and 136.) Cambridge: University Press, 1909. Size 7½ × 5. *Maps and Illustrations. Price* 1*s.* 6*d. per vol. Presented by the Publishers.*

United Kingdom—Forestry.

Royal Commission on Coast Erosion and Afforestation, vol. 2 (Part 1). Second report (on afforestation) of the Royal Commission appointed to inquire into and to report on certain questions affecting coast erosion, the reclamation of tidal lands, and afforestation in the United Kingdom. London, 1909. Size 13 × 8½, pp. x. and 48. *Price* 6*d.*

United Kingdom—Hants and Wilts. **Jukes-Browne and others.**

Memoirs of the Geological Survey: England and Wales. Explanation of Sheet 283. The Geology of the Country round Andover. By A. J. Jukes-Browne.

Partly from notes by F. J. Bennett and H. J. Osborne White. London, 1908. Size 9½ × 6, pp. vi. and 68. *Sections. Price* 1*s.* 6*d.*

United Kingdom—Kent. **Mill.**

The Rainfall of Kent. By Dr. Hugh Mill. [From the "Water Supply of Kent," *Mem. Geological Survey*, 1908.] Size 8½ × 6, pp. 20–27. *Map. Presented by the Author.*

Noticed in the Monthly Record, vol. **33**, p. 594.

United Kingdom—Nottinghamshire. **Lamplugh and others.**

Memoirs of the Geological Survey: England and Wales. Explanation of Sheet 126. The Geology of the Country between Newark and Nottingham. By G. W. Lamplugh, W. Gibson, R. S. Sherlock, and W. B. Wright. London, 1908. Size 9½ × 6, pp. vi. and 126. *Sketch-map and Section. Price* 2*s.* 3*d.*

United Kingdom—Ordnance Survey. **Johnston.**

The Ordnance Survey. By Colonel Sir Duncan Alexander Johnston. (From the *Building News*, vol. **96**, No. 2821; London, January 29, 1909.) Size 12½ × 9, pp. 170–173. *Presented by F. A. Edwards, Esq.*

United Kingdom—Scotland. **Kynaston, Hill, and others.**

Memoirs of the Geological Survey: Scotland. Explanation of Sheet 45. The Geology of the country near Oban and Dalmally. By H. Kynaston and J. B. Hill. With contributions by B. N. Peach, J. S. Grant Wilson, H. B. Muff, and E. B. Bailey; with Petrological notes by J. J. H. Teall and J. S. Flett. Glasgow: James Hadderwick & Sons, Ltd., 1908. Size 9½ × 6, pp. vi. and 184. *Illustrations. Price* 2*s.* 6*d.*

United Kingdom—Scotland. *Geol. Mag.* V. **6** (1909): 26–31. **Peach.**

Boulder Distribution from Lennoxtown, Scotland. By A. MacEwen Peach. *Sketch-maps.*

United Kingdom—Tweed. **Maxwell.**

The story of the Tweed. By the Rt. Hon. Sir Herbert Maxwell. London: J. Nisbet & Co., 1909. Size 8 × 5½, pp. x. and 374. *Illustrations. Price* 6*s. net. Presented by the Publishers.*

United Kingdom—Wiltshire. **Cox.**

A guide to Avebury and neighbourhood. By R. Hippisley Cox. London: E. Stanford, 1909. Size 9 × 6½, pp. 68. *Maps and Plans. Price* 2*s. net. Presented by the Publisher.*

ASIA.

Baluchistan. **Tate.**

The frontiers of Baluchistan: travels on the borders of Persia and Afghanistan. By G. P. Tate, with an Introduction by Col. Sir A. H. McMahon. London: Witherby & Co., 1909. Size 9 × 5½, pp. xvi. and 262. *Maps and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publishers.*

See review, *ante*, p. 198.

China. **Harfeld.**

Comdt. Harfeld. Opinions chinoises sur les barbares d'Occident. Paris: Plon-Nourrit & Cie., 1908. Size 8½ × 6, pp. viii. and 308. *Illustrations. Presented by the Author.*

Cyprus. **Hutchinson and Cobham.**

A handbook of Cyprus, 1909. Compiled by Sir T. Hutchinson and Claude Delaval Cobham. London: E. Stanford, 1909. Size 7 × 4½, pp. xii. and 138. *Maps and Illustrations. Price* 2*s.* 6*d. net. Presented by the Publisher.*

The present (sixth) issue of this useful handbook has again had careful revision.

French Indo-China—Annam. **Maitre.**

Les régions Moï du Sud Indo-Chinois: Le plateau du Darlac. Par Henri Maitre. Paris: Plon-Nourrit & Cie., 1909. Size 7½ × 5, pp. 332. *Sketch-map and Portrait. Price* 4 *fr. Presented by the Publishers.*

India.

The Imperial Gazetteer of India. New edition. Vols. **25** (Index) and **26** (Atlas). Oxford: Clarendon Press, 1909. Size 9 × 5½, pp. (vol. **25**) xxx. and 632; (vol. **26**) viii., 46 and 64 plates. *Price (per set of twenty-six vols.)* £5 *net. Presented by the India Office.*

This new edition is now complete.

India—Ethnology. **Risley.**

The People of India. By Sir Herbert Risley. Calcutta (London: W. Thacker & Co.), 1908. Size 9 × 6, pp. xvi., 290, and cxc. *Map, Illustrations, and Diagrams. Price 21s. net. Presented by the Author.*

India—Himalaya. **Mumm.**

Five months in the Himalaya: a record of mountain travel in Garhwal and Kashmir. By A. L. Mumm. London: E. Arnold, 1909. Size 10 × 6½, pp. xvi. and 264. *Maps and Illustrations. Price 21s. net. Presented by the Publisher.*

India—Historical. **Foster.**

The English factories in India, 1624–1629. A calendar of documents in the India Office, etc. By William Foster. Oxford: Clarendon Press, 1909. Size 9 × 6, pp. xlviii. and 388. *Facsimile-plan. Price 12s. 6d. net. Presented by the India Office.*

India—North-West Frontier. **Bird.**

Some principles of frontier mountain-warfare. By Bt.-Major W. D. Bird. London: H. Rees, 1909. Size 8½ × 5½, pp. 42. *Sketch-maps. Price 1s. net. Presented by the Publisher.*

Japan—Earthquakes. *B. Imp. Earthquake Investigation Com.* **2** (1908): 166–184. **Omori.**

On the Earthquakes of the Fuji Volcanic Chain. By Dr. F. Omori. *Sketch-maps.*

Japan—Ethnology. **Smith.**

Ancient tales and folklore of Japan. By Richard Gordon Smith. London: A. & C. Black, 1908. Size 9 × 6½, pp. xvi. and 362. *Illustrations. Price 20s. net. Presented by the Publishers.*

Japan—Formosa—Earthquakes. **Omori.**

B. Imp. Earthquake Investigation Com. **2** (1908): 148–155.

Earthquake Distributions in Formosa. By Dr. F. Omori. *Map.*

Japan and China. *B.S.R. Belge G.* **32** (1908): 365–385. **Harfeld.**

Des sanctuaires de Nikko à la Montagne des nuages blancs. Par le Commdt. F. Harfeld.

Malay Archipelago—Celebes. **Goedhart.**

Ts. Indische Taal-, Land-, en Volkenkunde **50** (1908): 442–548.

Drie landschappen in Celebes (Banggaai, Boengkoe en Mori). Door O. H. Goedhart.

Malay Peninsula—Language. **Mersier.**

Conversations en langue malaise (composées dans l'idiome usuel dans la Peninsule malaise), écrites en caractères arabes, transcrites en caractères latins et traduites en français par Albert Mersier. Paris: R. Monod, Poirré & Cie., 1905. Size 8½ × 7, pp. xxxvi. and 40. *Presented by the Author.*

Malay States—Keda. ——

Yearly report on the administration of the State of Kedah. September, 1905, to August, 1906. Calcutta, 1907. Size 13 × 8, pp. 36. *Illustration. Presented by the Colonial Office.*

Keda is one of the Siamese states lately ceded to Great Britain (see *ante*, p. 211).

Persia—Geology. *Petermanns M.* **55** (1909): 1–10. **Stahl.**

Geologische Beobachtungen im nordwestlichen Persien. Von A. F. Stahl. *Map.*

Philippine Islands. *Philippine J. Sci.* **3** (1908): 269–284. **Washburn.**

Health Conditions in the Philippines. By William S. Washburn.

Siam—Historical. **Turpin and Cartwright.**

History of the kingdom of Siam and of the revolutions that have caused the overthrow of the Empire, up to A.D. 1770. Compiled by M. Turpin. . . . Published originally at Paris, A.D. 1771. Translated . . . by B. B. Cartwright. Bangkok, 1908. Size 7 × 5, pp. vi. and 234. *Price 3s.*

Turkey—Palestine. **Conder.**

The city of Jerusalem. By Colonel C. R. Conder. London: J. Murray, 1909. Size 9 × 5½, pp. vi. and 334. *Plans and Illustrations. Price 12s. net. Presented by the Publisher.*

AFRICA.

Abyssinia. **Duchesne-Fournet.**

Jean Duchesne-Fournet. Mission en Ethiopie (1901–1903). 2 vols. and Atlas. Paris: Masson et Cie., 1909. Size 11 × 9, pp. (vol. 1) xviii. and 440; (vol. 2) xvi. and 388. *Portrait, Maps, and Illustrations. Price 60 fr.*

British East Africa. **Drumkey.**

Drumkey's Year-book for East Africa, 1909. Being a complete calendar, directory, and gazetteer for the British East Africa and the Zanzibar protectorates, and containing information about Uganda and German East Africa. Arranged and compiled by Y. S. A. Drumkey. Bombay: Times Press, 1909. Size 8½ × 6, pp. vi. and 394. *Maps. Price 7s. 6d.*

Takes the place of the official guide hitherto issued.

Egypt—Cairo. **Joanne.**

Collection des guides Joanne. Le Caire et ses environs. Paris: Hachette & Cie., 1909. Size 6½ × 4, pp. 182. *Maps, Plans, and Illustrations. Presented by the Publishers.*

Egypt—Kharga Oasis. **Beadnell.**

An Egyptian oasis: an account of the Oasis of Kharga in the Libyan desert, with special reference to its history, physical geography, and water-supply. By H. J. Llewellyn Beadnell. London: J. Murray, 1909. Size 8½ × 5½, pp. xiv. and 268. *Sketch-maps, Illustrations, and Section. Price 10s. 6d. net. Presented by the Publisher.*

Egypt—Sinai. **Weill.**

La presqu'île du Sinai: étude de géographie et d'histoire. Par Raymond Weill. Paris: H. Champion, 1908. Size 10 × 6½, pp. x. and 380. *Maps and Sections. Price 15 fr. Presented by the Publishers.*

Eritrea. *B.S.G. Italiana* **10** (1909): 251–301. **Verri.**

Contributo allo studio geografico della Colonia Eritrea. Del capitano Pietro Verri. *Map and Sketches.*

French Guinea. *B.S. Belge d'Etudes Col.* **16** (1909): 179–201. **Baillon.**

La Guinée Française. Par A. de Baillon. *Illustrations.*

French West Africa. *Rev. Française* **34** (1909): 65–79. **Demanche.**

La Question de Mauritanie. Par Georges Demanche. *Map.*

Deals with the region north of the Senegal.

Gold Coast. **Guggisberg.**

We two in West Africa. By "Decima Moore" and Major F. G. Guggisberg. London: W. Heinemann, 1909. Size 9 × 5½, pp. xvi. and 368. *Sketch-maps and Illustrations. Price 12s. 6d. net. Presented by the Publisher.*

Ivory Coast.

Gouvernement Général de l'Afrique Occidentale Française. Notices publiées par le Gouvernement Général à l'occasion de l'Exposition Coloniale de Marseille. La Côte d'Ivoire. Paris: G. Larose, 1906. Size 10 × 6½, pp. 762. *Map and Illustrations. Price 7.50 fr.*

Madagascar. *Jber. Frankfurter V.G.* **71–72** (1906–08): 110–114. **Voeltzkow.**

Madagascar. Von Prof. Dr. A. Voeltzkow.

Morocco—Survey. **Roquevaire.**

Cinq mois de triangulation au Maroc. Par R. de Flotte de Roquevaire. Algiers: A. Jourdan, 1909. Size 11 × 9, pp. 72 and xvi. *Maps, Sections, and Illustrations. Presented by the Author.*

Natal. *Z. Ges. E. Berlin*, 1909: 33–55. **Tabbert.**

Die wirtschaftsgeographischen Verhältnisse in Natal auf Grund eigener Anschauungen. Von Richard Tabbert. *Illustrations.*

Natal. **Harrison.**

Natal, an illustrated official railway guide and handbook of general information. Compiled and edited by C. W. Francis Harrison. London: Payne Jennings, 1903. Size 10 × 7½, pp. xii. and 300. *Maps, Plans, and Illustrations. Presented by the Compiler.*

Nigeria—Railways.

Nigeria. Further correspondence relating to Railway Construction in Nigeria.

London: Wyman & Sons. 1909. Size 13 × 8½, pp. viii. and 156. *Plans and Sketch. Price 2s. 1d.*

North Africa—Historical. **Peyssonnel and Rampal.**

B.G. hist. et descriptive, 1907 (1908): 317–340.

Une relation inédite du voyage en Barbarie du médicin naturaliste marsellais Peyssonnel. Par Auguste Rampal.

Nyasaland.

The handbook of Nyasaland, comprising historical, statistical, and general information concerning the Nyasaland Protectorate. Zomba: Government Printer, [1909]. Size 8½ × 5, pp. viii. and 292. *Illustrations. Presented by the Editor.*

Sahara—Tuareg. **Jean.**

Lieutenant C. Jean. Les Touareg du Sud-Est, l'Aïr, leur rôle dans la politique saharienne. Paris: E. Larose, 1909. Size 10 × 6½, pp. 362. *Maps and Illustrations. Price 10 fr.*

Tripoli. **Gregory.**

Report on the work of the Commission sent out by the Jewish Territorial Organization, under the auspices of the Governor-General of Tripoli, to examine the territory proposed for the purpose of a Jewish settlement in Cyrenaica. By Dr. J. W. Gregory. London: Ito Offices, 1909. Size 13 × 8½, pp. xiv. and 52. *Maps, Sections, and Illustrations. Presented by the Author.*

This will be noticed elsewhere.

Uganda. **Abruzzi and others.**

S. A. R. il Principe Luigi Amedeo di Savoya, Duca degli Abruzzi. Il Ruwenzori: Parte scientifica. Risultati delle osservazioni e studi compiuti sul materiale raccolto dalla spedizione. 2 vols. Milan: U. Hoepli, 1909. Size 10 × 7, pp. (vol. 1) xii. and 604; (vol. 2) xxii. and 286. *Maps and Illustrations. Price 50 lire. Presented by the Publisher.*

NORTH AMERICA.

Alaska. **Higginson.**

Alaska: the great country. By Ella Higginson. London: G. Bell & Sons, 1909. Size 7½ × 5, pp. x. and 538. *Map and Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

Canada—British Columbia—Ethnology. **Teit.**

The Jesup North Pacific Expedition. Vol. 2, part 7: The Shuswap. By James Teit. Leyden and New York, 1909. Size 14 × 11, pp. x. and 443–814. *Sketch-map and Illustrations. Price 15 florins.*

Canada—Historical. **Lescarbot, Biggar, and Grant.**

The history of New France. By Marc Lescarbot. With an English translation, notes, and appendices by W. L. Grant, and an introduction by H. P. Biggar. Vol. 1. (Publications of the Champlain Society, vol. 1.) Toronto, 1907. Size 9½ × 6½, pp. xxii. and 332. *Maps (facsimile and new). Purchased.*

The Champlain Society has been formed for the purpose of reprinting important early documents relating to Canada. The volumes, of which this is the first issue, are well edited and produced in excellent style.

Canada—Historical. **Laut.**

The conquest of the great North-West, being the story of the adventurers of England known as the Hudson's Bay Company. New pages in the history of Canadian North-West and Western States. By Agnes C. Laut. 2 vols. London: Hodder & Stoughton, 1909. Size 8½ × 5½, pp. (vol. 1) xxii. and 410; (vol. 2) x. and 416. *Maps and Illustrations. Price 21s. net. Presented by the Publishers.*

Canada—Historical. **Munro.**

Documents relating to the Seigniorial tenure in Canada, 1598–1854. Edited, with an historical introduction and explanatory notes, by Dr. William Bennett Munro. (Publications of the Champlain Society, III.) Toronto, 1908. Size 9½ × 6½, pp. cxxiv. and 380. *Purchased.*

Great Lakes. **Channing and Lansing.**

The story of the Great Lakes. By Edward Channing and Marion Florence Lansing. New York (London: Macmillan & Co.), 1909. Size 7½ × 5, pp. x. and 398. *Sketch-maps and Illustrations. Price 6s. 6d. net. Presented by the Publishers.*

United States—Atlantic Coast. *National G. Mag.* **19** (1908): 859–871. **Mayer.**

Our neglected southern coast. A cruise of the Carnegie Institution Yacht *Physalia*. By Alfred Goldsborough Mayer. *Illustrations.*

United States—California. *Sierra Club B.* **7** (1909): 1–22. **Le Conte.**

The high mountain route between Yosemite and the King's River Cañon. By Joseph N. Le Conte. *Sketch-map and Illustrations.*

United States—California. **Mendenhall.**

U.S. Geol. Surv. Water-Supply Paper **219** (1908): pp. 180.

Ground waters and irrigation enterprises in the Foothill Belt, Southern California. By Walter C. Mendenhall. *Maps, Sections, and Illustrations.*

United States—California—Earthquake. ——

The California earthquake of April 18, 1906. Report of the State Earthquake Investigation Commission. Vol. 1. Washington & Co., Carnegie Institution, 1908. Size 11½ × 9, pp. xviii. and 452. *Sketch-maps and Illustrations; and Separate Atlas* (size 24 × 19). *Price* $17.

United States—California—Earthquake. **Oldham.**

Quarterly J. Geol. S. **65** (1909): 1–20.

The Geological Interpretation of the Earth-movements associated with the Californian Earthquake of April 18, 1906. By Richard Dixon Oldham. *Sketch-map and Diagrams.*

United States—Columbia River. *Monthly Weather Rev.* **36** (1908): 235–236. **Beals.**

Annual rise of the Columbia river in 1908. The 1907 annual rise in the Columbia river. By E. A. Beals. *Diagram.*

United States—Guide-book. **Baedeker.**

The United States, with excursions to Mexico, Cuba, Porto Rico, and Alaska. Handbook for travellers by Karl Baedeker. 4th edition. Leipzig: K. Baedeker (London: T. Fisher Unwin), 1909. Size 6½ × 4, pp. cii. and 724. *Maps and Plans. Price* 15*s*. *Presented by the Editor.*

CENTRAL AND SOUTH AMERICA.

Andes—Relief. **Huot.**

Mission Scientifique G. de Créqui Montfort et E. Sénéchal de la Grange. Géographie des hauts-plateaux des Andes. Par V. Huot. Paris: Imprimerie Nationale, 1908. Size 11 × 7½, pp. 84. *Presented by M. G. de Créqui Montfort.*

Brazil. **Denis.**

Pierre Denis. Le Brésil au XX^e^ Siècle. Paris: A. Colin, 1909. Size 7 × 5, pp. 312. *Price* 3.50 *fr.*

A compact and useful sketch of present-day Brazil.

Brazil—Minas. **Carvalho.**

Carlos M. D. de Carvalho. Un centre économique au Brésil: l'État de Minas en 1908. Paris: Service de Propagande et d'Expansion Économique du Brésil, [1908]. Size 7½ × 4½, pp. 188. *Sketch-map. Presented by the Service d'Expansion Economique.*

Brazil—Year-book. **Wileman.**

The Brazilian Year-book; issued under the patronage of the Brazilian Government. First issue, 1908. Compiled and edited by J. P. Wileman. Rio de Janeiro (London: McCorquodale & Co.), 1908. Size 10 × 6, pp. xxiv., vi., and 780. *Maps and Diagrams. Presented.*

Embodies much useful information, descriptive and statistical.

Chile—Magallanes. **Avaria.**

Censo jeneral de poblacion i edificacion, industria, ganaderia i mineria del territorio de Magallanes, República de Chile; levantado por acuerdo de la Comision de Alcaldes el dia 8 de Setiembre de 1906. Pasado i presente del territorio di Magallanes. Por Lautaro Navarro Avaria. Two vols. Punta Arenas, 1907–1908. Size 11½ × 8, pp. (vol. 1) lxvi. and 382; (vol. 2) 564. *Maps, Diagrams, and Illustrations. Presented by B. R. Fleming, Esq.*

Chile—Strait of Magellan. **Pacheco.**

Importancia de la Via de Magallanes para el comercio de la América. Por Baldomero Pacheco. Valparaiso, 1908. Size 10 × 6½, pp. 16. *Chart.*

Chile and Argentine. **Luco.**

Luis Orrego Luco. Los problemas internacionales de Chile; la cuestión Argentina; la Patagonia; hasta el Tratado de 1881. Santiago, 1902. Size 7½ × 5, pp. 336. *Presented by the Ministro des Relaciones Exteriores, Chile.*

Hayti. *Petermanns M.* **55** (1909): 49–57. **Tippenhauer.**

Neuer Beitrag zur Topographie, Bevölkerungskunde und Geologie Haitis. Von L. Gentil Tippenhauer. *Map.*

Panama Canal. **Regel.**

Der Panamakanal. Von Dr. Fritz Regel. (Angewandte Geographie . . . III. Serie, 6 Heft.) Halle-a.-S., Gebauer-Schwetschke, 1909. Size 8¼ × 5½, pp. 128. *Maps and Illustrations. Price* 4*m.*

South America—Anthropology. **Roman.**

Mission Scientifique G. de Créqui Montfort et E. Sénéchal de la Grange. Antiquités de la region andine, de la République argentine, et du désert d'Atacama. Par Éric Boman. Tome I^er^. Paris: Imprimerie Nationale, 1908. Size 11 × 7½, pp. xii. and 388. *Maps, Plans, and Illustrations. Presented by M. G. de Créqui Montfort.*

South America—Travel. **Mann.**

Yachting on the Pacific; together with notes on travel in Peru, and an account of the peoples and products of Ecuador. By Alexander Mann. London: Duckworth & Co., 1909. Size 8 × 5, pp. xii. and 286. *Illustration. Price* 6*s. Presented by the Author.*

West Indies—Cuba. **Olmstead and Gannett.**

Cuba: population, history, and resources, 1907. Compiled by V. H. Olmstead and H. Gannett. Washington: U.S. Census Bureau, 1909. Size 9 × 6, pp. 276. *Illustrations.*

A useful compendium of information derived from census reports and other sources.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia. **Wise.**

The Commonwealth of Australia. By B. R. Wise. London: Sir I. Pitman & Sons, 1909. Size 8½ × 5½, pp. xvi. and 356. *Maps and Illustrations. Price* 7*s.* 6*d. net. Presented by the Publishers.*

Easter Island. **Corney.**

The voyage of Captain Don Felipe Gonzalez in the ship of the line *San Lorenzo*, with the frigate *Santa Rosalia* in company, to Easter Island in 1770–1; preceded by an extract from Mynheer Jacob Roggeveen's Official Log of his discovery of and visit to Easter Island in 1722. Transcribed, translated, and edited by Bolton Glanville Corney. (Hakluyt Society Publ., Second Series, No. 13.) Cambridge, 1908. Size 9 × 5½, pp. lxxviii. and 176. *Facsimile Charts and Illustrations. Presented by the Hakluyt Society.*

The narrative of a little-known voyage, now made available for the first time.

New Britain. **Pullen-Burry.**

In a German colony, or Four weeks in New Britain. By B. Pullen-Burry. London: Methuen & Co., 1909. Size 7½ × 5, pp. xii. and 238. *Sketch-maps and Illustrations. Price* 5*s. net. Presented by the Publishers.*

New Zealand—Botany. **Cockayne.**

New Zealand: Department of Lands. Report on a botanical survey of the Tongariro National Park. By Dr. L. Cockayne. Wellington, 1908. Size 13 × 8½, pp. 42. *Map and Illustrations.*

New Zealand—Forests. **Cockayne.**

New Zealand: Department of Lands. Report on a botanical survey of the Waipona Kauri forest. By Dr. L. Cockayne. Wellington, 1908. Size 13 × 8½, pp. 44. *Map and Illustrations.*

Peru—Industries.

Memoria presentada por el Director de Fomento, Dr. Carlos Larrabure i Correa, al Señor Ministro del Ramo, 1907–1908. Tomo I. Lima, 1908. Size 9 × 9½, pp. ccxlviii. and 614. *Map and Illustrations.*

Peru and Bolivia—Goldfields. *J.R.S. Arts* 57 (1908): 29–40. **Conway.**

The Goldfields of Eastern Peru and Bolivia. By Sir W. Martin Conway. *Sketch-map.*

Salvador. **Escamilla.**

Geografia Economica de la Republica de El Salvador. Por Miguel Escamilla. San Salvador, 1908. Size 9 × 6½, pp. 56. *Presented by the Author.*

Venezuela—Hydrography. *Z. Ges. E. Berlin* (1909): 98–121. **Jahn.**

Beiträge zur Hydrographie des Orinoco und Rio Negro. Von A. Jahn. *Map and Illustrations.*

West Indies—Coral Reefs. *M.G. Ges. München* **3** (1908): 129–133. **Hartmeyer.**

Die Korallenriffe Westindiens mit besonderer Berücksichtigung der Tortugas-Inseln. Von Dr. Hartmeyer.

POLAR REGIONS.

Antarctic—German Expedition. **Drygalski.**

Deutsche Südpolar-Expedition, 1901–1903 . . . herausgegeben von Erich von Drygalski. X. Band (Zoologie, II. Band), Heft 5. Berlin: G. Reimer, 1909, Size 13½ × 10, pp. viii. and 533–604. *Illustrations.*

Polar Congress. *B.S.R. Belge G.* **32** (1908): 303–312. **Denucé.**

La Commission polaire internationale à la Conférence de Bruxelles (mai 1908) et au IX^e^ Congrès international de Géographie (Genève, juillet-août 1908). Par J. Denucé.

Polar Exploration. *Fortnightly Rev.* **84** (1908): 1029–1037. **Bruce.**

Aims and Objects of modern Polar Exploration. By Dr. William S. Bruce.

Polar Regions—Climate. *Symons's Met. Mag.* **44** (1909): 1–6. **Mossman.**

The cold period of May in Arctic and Antarctic regions, with special reference to 1903. By R. C. Mossman.

Polar Research. **Lecointe.**

The General Organization of the International Polar Institute. By G. Lecointe. Brussels, 1908. Size 9½ × 6, pp. 12.

Spitzbergen—Survey. *Z. Ges. E. Berlin* (1908): 599–604. **Bock.**

Versuch photogrammetrischer Küstenaufnahmen gelegentlich einer Spitzbergen-Expedition im Sommer 1907. Von F.-K. von Bock. *Illustrations.*

MATHEMATICAL GEOGRAPHY.

Aerial Navigation. **Marcuse.**

Astronomische Ortsbestimmung im Ballon. Von Prof. Dr. Adolf Marcuse. Berlin: G. Reimer, 1909. Size 9½ × 7, pp. 68. *Sketch-maps and Diagram. Price 5s.*

Orientation. **Tilney.**

Rapid night-marching made easy; consisting of simple rules for finding the true bearing by means of stars, suitable for soldiers, explorers, and travellers generally. With a description of Reeves' Astronomical Compass and Time Indicator. By Major W. A. Tilney. London: E. Stanford, 1909. Size 9 × 8½, pp. 16. *Charts and Diagrams. Price 2s. 6d. net. Presented by the Publisher.*

The instrument alluded to was described in the *Journal* for December, 1908, p. 608.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Earth-History. **Joly.**

Radioactivity and geology: an account of the influence of radioactive energy on terrestrial history. By Dr. J. Joly. London: A. Constable & Co., 1909. Size 7½ × 5, pp. xvi. and 288. *Illustrations and Diagrams. Price 7s. 6d. Presented by the Publishers.*

Ice. **Barnes.**

Ice-formation, with special reference to anchor-ice and frazil. By Dr. Howard T. Barnes. New York (London: Chapman & Hall), 1906. Size 9 × 6, pp. x. and 260. *Diagrams and Illustrations. Price 12s. 6d. net.*

Magnetism. **Birkeland.**

The Norwegian Aurora Polaris Expedition, 1902–1903. Vol. 1. On the cause of magnetic storms and the origin of terrestrial magnetism. By Kr. Birkeland. (First Section.) Christiania (London: Longmans, Green & Co.), [1909]. Size 13 × 10, pp. viii. and 316. *Maps, Illustrations, and Diagrams. Price 22s.*

Meteorology. **Scott.**

Notes on meteorology and weather forecasting for junior navigators. By Commr. A. C. Scott. London, etc.: Griffin & Co., 1909. Size 10 × 6, pp. viii. and 40. *Sketch-maps and Diagrams. Price 5s. net. Presented by the Publishers.*

Meteorology—Observatories. *La G., B.S.G. Paris* **18** (1908): 361-374. **Baillaud.**

Les observatoires de montagne. Par B. Baillaud. *Illustrations.*

Meteorology—Pressure. *Ymer* **28** (1908): 345-406. **Ekholm.**

Om lufttryckets ändringar och därmed sammanhängande företeelser. Af Nils Ekholm. *Sketch-maps.*

Oceanography—Baltic Sea. *B.A. Imp. Sci. St. Petersbourg* (1908): 1181-1184. **Nasonov.**

Sur les résultats des travaux de la mission scientifiques de N. M. Knipovič et S. A. Pavlovič dans la mer Baltique. Par N. Nasonov. [In Russian.]

Oceanography—Black Sea. **Nasonov.**

B.A. Imp. Sci. St. Petersbourg (1908): 1185-1188.

Sur les résultats des travaux de la mission scientifique de K. P. Jagodovskij dans la mer Noire. Par N. Nasonov. [In Russian.]

Oceanography—English Channel. **Devoir.**

B.I. Oceanogr., Monaco, No. **125** (1908): pp. 56.

Essai sur les mouvements de la mer aux abords du Mont Saint-Michel (Époques actuelle et préhistorique). Par Alf. Devoir. *Maps and Diagrams.*

Oceanography—Indian Ocean. **Gardiner and others.**

Reports of the Percy Sladen Trust Expedition to the Indian Ocean in 1905, under the leadership of J. Stanley Gardiner. Vol. 1. (Being the twelfth volume of the Second Series, Zoology, of the *Transactions of the Linnean Society of London.*) London, 1907-09. Size 12 × 9½, pp. xxii. and 420. *Portrait, maps, and Illustrations. Presented by Dr. J. Stanley Gardiner.*

This volume includes parts i. and ii. of the narrative of the expedition, and a number of special reports on the collections.

Oceanography—Terms. *Riv. G. Italiana* **15** (1908): 513-526. **Ricchieri and others.**

Per la terminologia dei fondi oceanici. Seconda relazione e conclusioni definitive della Commissione nominata del Congresso di Venezia.

Sets forth the Italian equivalents adopted for the terms adopted by the International Commission, with some other terms for features not dealt with by that body.

Phytogeography. **Warming**

Œcology of plants: an introduction to the study of plant-communities. By Eug. Warming, assisted by Martin Vahl. Oxford: Clarendon Press, 1909. Size 10½ × 6½, pp. xii. and 422. *Price 8s. 6d. net. Presented by the Publishers.*

To be reviewed.

Seismology. *Beiträge Geophysik* **9** (1908): 559-571. **Gerland.**

Das seismische Verhalten des Atlantischen und des Pazifischen Ozeans. Von G. Gerland.

Seismology. *Science* **29** (1909): 121-138. **Gilbert.**

Earthquake Forecasts. By G. K. Gilbert.

Seismology. *B. Imp. Earthquake Investigation Com.* **2** (1908): 89-100. **Omori.**

On the Fore-shocks of Earthquakes. By Dr. F. Omori. *Diagram.*

Zoogeography—Mosquitos. **Ballou.**

"Millions" and mosquitos. By H. A. Ballou. (Imperial Department of Agriculture for the West Indies, Pamphlet Series, No. 55.) [Barbabos], 1908. Size 7½ × 5, pp. 16. *Illustration.*

"Millions" is the name of a small fish that feeds on the eggs, etc., of mosquitos.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography—Hellenes. **Hogarth.**

Ionia and the East. Six lectures delivered before the University of London by David G. Hogarth. Oxford: Clarendon Press, 1909. Size 9 × 5½, pp. 118. *Map. Price 3s. 6d. net. Presented by the Publishers.*

Commercial—Telegraphs. **Bright.**

Submarine Telegraphy. By Charles Bright. (From the *Journal of the Royal United*

Service Institution, vol. **52**, 1907.) London, 1907. Size 9½ × 6, pp. 30. *Map, Sections, Portraits, and Illustrations. Presented by the Author.*

Commercial—Transport. **Smith**

The ocean carrier: a history and analysis of the service and a discussion of the rates of transportation. By Dr. J. Russell-Smith. New York and London: G. P. Putnam's Sons, 1908. Size 7½ × 5, pp. xii. and 344. *Maps and Illustrations. Price* 6*s.*

Historical. **Bouvier and Hamy.**

Recueil de voyages et de documents pour servir à l'histoire de la geographie . . . . Tome **22**. Le livre de la description des pays de Gilles le Bouvier dit Berry. Publié . . . avec une introduction et des notes, et suivi de l'*Itinéraire Brugeois*, de la *Table de Velletri*, et de plusieurs autres documents géographiques . . . du XV^e^ siècle, recueillis et commentés par le Dr. E. T. Hamy. Paris: E. Leroux, 1908. Size 11 × 7½, pp. 264. *Facsimile map and Illustrations. Price* 40 *fr.*

Historical—Aristotle. **Bolchert.**

Quellen u. Forschungen zur alten Geschichte u. G. (*Sieglin*), Heft **15** (1908): pp. x. and 102.

Aristoteles Erdkunde von Asien und Libyen. Von Paul Bolchert. *Price* 3 *m.* 60 *pf.*

Historical Geography. **Johnston.**

A sketch of historical geography. By Keith Johnston. (Reprinted from the Sixth Edition of his 'Geography.') With an appreciation of the author by Sir Clements R. Markham. Paris: E. Stanford, 1909. Size 8 × 5½, pp. x. and 232. *Maps. Price* 3*s.* 6*d. net. Presented by the Publisher.*

Perhaps the best outline that has appeared of the gradual unfolding of a knowledge of the world in its relation to political events.

History of Cartography. **Kretschmer.**

Die italienischen Portolane des Mittelalters. Ein Beitrag zur Geschichte der Kartographie und Nautik von Konrad Kretschmer. (Veröffentlichungen des Instituts für Meereskunde und des Geographischen Instituts an der Universität Berlin . . . Heft 13.) Berlin: E. S. Mittler u. Sohn, 1909. Size 10½ × 7, pp. viii. and 688. *Facsimile chart. Presented by the Institute.*

This important work will be specially noticed.

BIOGRAPHY.

Baer. *Münchener G. Studien* (*Günther*) **23** (1909): pp. 90. **Heydenreich.**

Karl Ernst von Baer als Geograph. Von Alfred Heydenreich. *Sketch-maps.*

Crowther. **Page.**

The black bishop: Samuel Adjai Crowther. By Jesse Page. London: Hodder & Stoughton, 1908. Size 8½ × 6, pp. xvi. and 440. *Portraits and Illustrations. Price* 7*s.* 6*d. net. Presented by the Publishers.*

Du Fief. *B.S.R. Belge G.* **32** (1908): 333–344. ———

J. B. du Fief. *Portrait.*

See March number, p. 336.

Galileo. **Müller.**

Galileo Galilei und das kopernikanische Weltsystem. Von Adolf Müller, *S.J.* Freiburg i. B.: Herder, 1909. Size 9 × 6, pp. xii. and 184. *Portrait. Price* 3*m.* 40. *Presented by the Publisher.*

Grenfell. **Hawker.**

The life of George Grenfell, Congo missionary and explorer. By George Hawker. London: Religious Tract Society, 1909. Size 8½ × 5½, pp. xxvi. and 588. *Portraits, Maps, and Illustrations. Price* 6*s. net. Presented by the Publishers.*

Marinelli. ———

Scritti minori di Giovanni Marinelli. A cura del Comitato per le Onoranze alla Memoria di Giovanni Marinelli. Vol. I. Florence: M. Ricci, 1908. Size 9½ × 6½, pp. xlviii. and 638. *Portrait and Facsimile Map. Price* 10 *lire.*

Geographers will welcome this reprint of Marinelli's lesser writings, some of which have not been easily accessible.

Moresby. **Moresby.**

Two admirals; Admiral of the Fleet Sir Fairfax Moresby (1786–1877), and his son, John Moresby. A record of life and service in the British Navy for a hundred

years. By Admiral John Moresby. London: J. Murray, 1909. Size 9 × 5½, pp. xii. and 420. *Maps, Portraits, and Illustrations. Price* 14*s. net. Presented by the Publisher.*

Wilson. **Watson.**

The life of Major-General Sir Charles William Wilson, R.E. By Col. Sir Charles M. Watson. London: J. Murray, 1909. Size 9 × 5½, pp. xvi. and 420. *Portraits, Maps, and Illustrations. Price* 15*s. net. Presented by the Publisher.*

GENERAL.

Almanac. **Olsen.**

The Fisherman's Nautical Almanac and Tide Tables. A Directory of British and Foreign Fishing Vessels, Steamers, etc. By O. T. Olsen. 33rd year, 1909. Size 7 × 5, pp. xlii. and 550. *Price* 1*s. Presented by the Author.*

British Empire. **Heaton.**

A scientific geography. Book vii. The British Empire. By Ellis W. Heaton. London: Ralph, Holland & Co., 1909. Size 7½ × 5, pp 244. *Sketch-maps. Price* 2*s. net. Presented by the Publishers.*

British Empire **Pollard.**

The British Empire: its past, its present, and its future. Edited by A. F. Pollard. London: League of the Empire, 1909. Size 8½ × 5½, pp. xxxii. and 864. *Price* 5*s. net.*

Education—Text-book. **Evans.**

A general geography of the world; physical, historical, and political; with glossary, pronouncing index, praxis, and other appendices. By Henry E. Evans. London: Blackie & Sons, 1909. Size 7½ × 5, pp. xii. and 440. *Price* 3*s.* 6*d. Presented by the Publishers.*

Education—Text-book. **Unstead.**

The Oxford Geographies. Practical geography, Part II. By J. F. Unstead. Oxford: Clarendon Press, 1909. Size 7½ × 5, pp. 112. *Sketch-maps and Diagrams. Price* 1*s.* 6*d. Presented by the Publishers.*

Geography. *R. Engineers J.* **9** (1909): 169–180. **Close.**

Recent Progress in Geographical work. By Lieut.-Colonel C. F. Close. *Map, Plans, and Diagram.*

The author would limit geography to geodesy, topography, and physical geography.

German Colonies.

Jahresbericht über die Entwickelung der Schutzgebiete in Afrika und der Südsee im Jahre 1907–08. 8 Teile, and "Anhang." Berlin, 1909. Size 12 × 8½. *Map and Illustrations.*

Hints to travellers. **Shelford.**

Pioneering. By Frederic Shelford. (A series of four articles contributed to the *Engineer* revised.) London: E. & F. N. Spon, 1909. Size 7½ × 5, pp. vi. and 82. *Illustrations. Price* 3*s. net. Presented by the Publishers.*

Tropical hygiene. **Brooke.**

Tropical medicine, hygiene, and parasitology. A handbook for practitioners and students. By Dr. Gilbert E. Brooke. London: C. Griffin & Co., 1908. Size 6½ × 4, pp. xvi. 498. *Maps, Illustrations, and Diagrams. Price* 12*s.* 6*d. net. Two copies, presented by the Author and Publishers.*

Year-book. **Haack.**

Geographen-Kalendar. In Verbindung mit vielen Fachgenossen herausgegeben von Dr. Hermann Haack. vii. Jahrgang, 1909. Gotha: J. Perthes, 1909. Size 6 × 4, pp. vi. and 884. *Maps. Price* 6*m. Two copies, presented and purchased.*

Year-book. **Keltie and Renwick.**

The Statesman's Year-book: statistical and historical annual of the States of the World for the year 1909. Edited by J. Scott Keltie, with the assistance of I. P. A. Renwick. London: Macmillan & Co., 1909. Size 7 × 4½, pp. lxxvi. and 1404. *Maps and diagrams. Price* 10*s.* 6*d. net. Presented by the Publishers.*

This issue has been subjected to a more searching revision than usual, considerable changes having been made with a view to reducing the bulk. It contains, as usual, a number of maps illustrating recent occurrences in political geography.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Balkan Peninsula. **Cvijić.**

Uebersichtskarte und Profile der dinarischen Rumpfflächen. Von Prof. J. Cvijić. Scale 1 : 600,000 or 1 inch to 9·5 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1909, Tafel 12. Gotha: Justus Perthes, 1909. *Presented by the Publisher.*

Belgium. **Deventer.**

Atlas des Villes de la Belgique au XVI^e^ Siècle. Cent Plans du Géographe Jacques de Deventer exécutés sur les ordres de Charles-Quint et de Philippe II. reproduits en Facsimilé Chromographique par l'Institute National de Géographie, à Bruxelles. Publication commencée par Ch. Ruelens, et continuée sous la direction de Ém. Ouverleaux et J. van den Gheyn, S.J. 16^e^ Livraison. Brussels: M. Weissenbruch; Falk Fils, 1908.

This is the sixteenth part of an important atlas of sixteenth-century facsimile plans of the towns of Belgium, from the original drawings of Jacques de Deventer, and contains plans of Gard, Lierre, and Ruremonde. Owing to unavoidable circumstances, the publication has been suspended since 1895, when the fifteenth part appeared; but now it is hoped to bring the work to a speedy and satisfactory conclusion. The plans have been carefully reproduced in the colours of the originals, and each is accompanied by an index-plan and explanatory text. To students of historical geography this work cannot fail to be of special interest.

British Isles—Edinburgh. **Bartholomew.**

Pocket Plan of Edinburgh and Suburbs. Scale 1 : 15,840 or 4 inches to 1 stat. mile. Edinburgh: John Bartholomew & Co., [1909]. *Price* 1*s. mounted on cloth. Presented by the Publishers.*

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from June 1 to 30, 1909.

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1, 2, 4; CXXXII. 2, 6; CXXXIII. 4, 13, 16; CXXXIV. 1, 2, 3, 5, 6, 8, 9, 10, 14, 15, 16; CXLVIII. 12; CL. 2; CLII. 9, 11, 13, 14; CLVI. 4, 6, 12, 14; CLVII. 9; CLXXI. 3; CLXXIII. 2, 3, 8, 9, 10, 11; CLXXXV. 9: 3*s. each*; LXIII. 6; XCV. 14: 1*s.* 6*d. each.*

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(*E. Stanford, London Agent.*)

Germany. **K. Preuss. Landesaufnahme.**

Karte des Deutschen Reiches. Scale 1:100,000 or 1 inch to 1·6 stat. mile. Sheet 590, Stuttgart. Berlin: K. Preuss. Landesaufnahme, 1909. *Price* 1.50*m. each sheet.*

Germany. **Reichs-Eisenbahn-Amt, Berlin.**

Uebersichtskarte des Eisenbahnen Deutschlands. Bearbeitet im Reichs-Eisenbahn-Amt, Berlin. Siebzehnte Auflage. Scale 1:1,000,000 or 1 inch to 15·8 stat. miles. 6 sheets. Berlin: Simon Schropp, 1909.

ASIA.

Asia. **Johnston.**

Bathy-Orographical map of Asia. Scale 1:9,350,000 or 1 inch to 147·5 stat. miles. Edinburgh and London: W. & A. K. Johnston, Ltd., 1909. *Price, mounted on rollers and varnished,* 12*s. Presented by the Publishers.*

Caucasus. **Dirr.**

Karte der Kürinischen Sprachgruppe (Südost-Daghestan und angrenzende Teile Transkaukasiens. Von A. Dirr. Scale 1:420,000 or 1 inch to 6·6 stat. miles. *Petermanns Mitteilungen,* Jahrgang 1909, Tafel 16. Gotha: Justus Perthes, 1909. *Presented by the Publisher.*

China. **K. Preuss. Landesaufnahme.**

Karte von Tschili und Schantung. Bearbeitet in der Kartogr. Abteilung der Kgl. Preuss. Landesaufnahme. Scale 1:200,000 or 1 inch to 3·2 stat. miles. Sheets: B 11, Wu tái hsiën; B 12, Dsing hsing hs.; B 13, Ping ding dschóu; C 8, Kalgan; C 9, Huái an hsiën; C 10, Yü dschou; C 15, Dschang de fu; C 16, Wei hui fu; C 17, Kái feng fu; D 8, Tschi tscheng hsiën; D 10, Yi dschou; D 15, Dung tschang fu; D 16, Pu dschóu; D 17, Tsáu dschóu fu; E 15, Dung a hsiën; E 16, Yen dschóu fu; E 17, Schan hsiën; F 15, Tsi nan fu; F 16, Tsü fu hsiën; F 17, I hsiën; G 15, Lin tsü hsiën; G 16, Dsü dschóu; G 17, I dschóu fu; H 15, Gáu mi hsiën; H 16, Dschu tscheng hsiën; H 17, Hái dschóu; I 15, Tsingtau; I 16, Ling schan wéi. Berlin: Simon Schropp, 1907.

Indian Government Surveys. **Surveyor-General of India.**

India and adjacent countries. Scale 1:1,000,000. Sheet 33, part of Afghanistan (1908). Scale 1 inch to 2 miles. Sheets: 84 $\frac{L}{5}$, $\frac{L}{7}$, $\frac{L}{8}$, $\frac{L}{9}$, $\frac{N}{8}$, $\frac{O}{1}$, $\frac{O}{6}$, $\frac{O}{9}$, Burma (1908). Scale 1 inch to 1 mile. Sheets: 39 $\frac{J}{15}$, $\frac{K}{13}$, $\frac{K}{14}$, $\frac{N}{11}$, $\frac{O}{1}$, $\frac{O}{7}$, 44 $\frac{C}{6}$, Punjab (1908); 55 $\frac{I}{1}$, Central India, 1908; 63 $\frac{G}{11}$, $\frac{K}{3}$, $\frac{N}{4}$, United Provinces (1907); 93 $\frac{C}{6}$, 94 $\frac{A}{16}$, Burma (1908).—North-Western Trans-Frontier, scale 1 inch to 2 miles. Sheets: 330 (1906), 362, 363 (1907), 438, 442, 452 (1906), 446, 467, 470 (1907).—North-Western Trans-Frontier, scale 1 inch to 4 miles. Sheets: 18 S.E., 19 S.E., 27 N.W. (1906).—North-Eastern Frontier, scale 1 inch to 16 miles. Sheets: $\frac{5-12}{6-13}$ (1908). Bengal: district maps, scale 1 inch to 4 miles, Darbhanga district (1908). Scale 1 inch to 8 miles, Saran district (1907); Twenty-Four Parganas district (1907).—Bengal Survey, scale 1 inch to 1 mile. Sheets: 37, 85 (1907), 131 (1905), 149 (1906), 159, 199 (1908), 200, 201 (1907), 217 (1905), 257 (1908), 264 (1907), 279 (1905), 316 (1907).—Bombay Survey, scale 1 inch to 1 mile. Sheets: 255 (1906), 276 (1902).—Burma Survey, scale 1 inch to 1 mile. Sheets: 141, 168 (1907), 215 (1908), 216, 256, 510 (1907).—Central India and Rajputana Survey, scale 1 inch to 1 mile. Sheet 311 (1906).—Central Provinces: district

maps, scale 1 inch to 4 miles, Bilaspur district (1908), Jubbulpore district (1908).—Central Provinces Survey, scale 1 inch to 1 mile. Sheet 132 (1907). Eastern Bengal and Assam: district maps, scale 1 inch to 8 miles, Chittagong district (1905).—Eastern Bengal and Assam Survey, scale 1 inch to 1 mile. Sheet 8 (1907).—Madras Survey, scale 1 inch to 1 mile. Sheet 136 (1906).—North-West Frontier: district maps, scale 1 inch to 4 miles, Bannu district (1906).—Punjab Survey, scale 1 inch to 1 mile. Sheets: 15 (1902), 35, 58, 60, 61 (1907), 144 (1906), 247, 264, 310 E (1908), 312 E (1907), 322, 334 (1907).—United Provinces: district maps, scale 1 inch to 8 miles, Allahabad district (1906), Keri district (1906).—United Provinces Survey, scale 1 inch to 1 mile. Sheets: 34 (1903), 86, 87, 88, 102 (1907), 135 (1906), 145, 148, 159 (1908), 192 (1905), 217 (1907). Calcutta: Surveyor-General's Office, 1909. *Presented by the Secretary of State for India, through the India Office.*

Tong'king. **Service Géographique de l'Indo-China.**

Carte du Delta du Tonkin. Scale 1:25,000 or 2·5 inches to 1 stat. mile. Sheets: 17, Dông-Triêu; 23, Yên-Lu'u; 24, Mai-Dông; 25, Quang-yên; 29, Gia-Lôc; 30, Kim-Thành; 31, Hai-Phong; 32, Quang-Yên (sud); 36, My-Dông; 39, Dô-Sôn; 43, Quinh-Côi; 46, Hôn-Dâu; 50, Phu-Tiên-Hu'ng; 52, Thuy-Anh; 56, Thái-Binh; 57, Kiên-Xu'o'ng; 61, Phû-Xuân-Trù'o'ng; 62, Cu'a-Ba-Lat. Hanoi: Service Geographique de l'Indo-Chine, 1904-05. *Price 1 piastre each sheet.*

AFRICA.

Africa. **Geographical Section, General Staff.**

Map of Africa. Scale 1:250,000 or 1 inch to 3·94 stat. miles. Sheet: 62-M, Zungeru, Northern Nigeria. London: Geographical Section, General Staff, War Office, 1909. *Presented by the Director of Military Operations.*

Algeria. **Service Cartographique de l'Algérie.**

Carte de l'Algérie. Dressée par ordre de Monsieur Jonnart, Gouverneur-Général de l'Algérie. Scale 1:200,000 or 1 inch to 3·2 stat. miles. Sheet 7, Constantine. Algiers: Adolphe Jourdan, [1909]. *Price 1 fr. each sheet. Presented by M. R. de Flotte de Roquevaire, Chef de Service Cartographique du Gouvernement Général de l'Algérie.*

Belgian Congo. **Lebègue.**

Carte du Congo Belge. Scale 1:4,000,000 or 1 inch to 63·1 stat. miles. Brussels: J. Lebègue & Cie., [1909].

Egypt. **Survey Department, Cairo.**

Map of Egypt. Scale 1:50,000 or 1·3 inch to 1 stat. mile. Sheets: N.E. IV.–I. Santa; V–I. Mehalla el Kubra; V.–II. Simbellawein; V.–V. El Managat; VI.–IV. Menzala; VIII.–III. Kafr el Battikh; N.W. IV.–I. Tanta. Cairo: Survey Department, 1908–09. *Presented by the Director-General, Survey Department, Cairo.*

French Congo. **Bruel.**

Carte du Chari dressée par G. Bruel, 1905–06, par ordre de M. Gentil, Commissaire Général du Congo Français. Scale 1:200,000 or 1 inch to 3·2 stat. miles. 19 sheets. Paris: Service Géographique de Colonies, 1908.

During recent years much fresh geographical information has been obtained concerning the Chari river region between the Ubangi and Lake Chad, and although the principal cartographical results of the expeditions under the command of various French officers have been separately published on small maps, this map is the first upon which the whole of the explorations and surveys up to 1906 have been combined on a large scale.

This map, which consists of nineteen sheets, each measuring 17 inches × 26 inches, was originally drawn in considerable detail on the scale of 1:100,000, and afterwards reduced for publication to half the scale. The routes followed by travellers, with the names attached, are shown, and along these are the heights of land, breadth of rivers, and as much other geographical detail as could be conveniently laid down without overcrowding. The latitudes and longitudes of important places from astronomical observations are given on the border of each sheet, but for full information, fixing of positions, methods of survey, instruments used, and the construction of the map in general, reference should be made to the pamphlet which accompanies the map, and which is commendably complete in its way. In this will also be found the authorities upon which the map has been compiled, which includes the author's own surveys, those of MM. Courtet and Chevalier, and others.

AMERICA.

Canada. **Department of the Interior, Ottawa.**

Map showing elevators in Manitoba, Saskatchewan, and Alberta. Scale 1 : 1,584,000 or 1 inch to 25 stat. miles. Ottawa : Department of the Interior, 1909. *Presented by the Department of the Interior, Ottawa.*

An outline map distinguishing the different railway systems by different colours, and giving the names of the grain elevators upon these, with their capacities in red figures.

Canada. **Department of the Interior, Ottawa.**

Resource map of the Dominion of Canada. Scale 1 : 12,000,000 or 1 inch to 197·3 stat. miles. Ottawa : Department of the Interior, 1909. *Presented by the Department of the Interior, Ottawa.*

A small general map of the Dominion of Canada, with the names of the principal products and resources indicated in red. It is folded into a small cover for the pocket, and is accompanied by tables of statistics.

Canada. **Department of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets : 71, Brandon, revised to November 26, 1908 ; 122, Manitoba House, revised to February 10, 1909. Ottawa : Department of the Interior, Topographical Surveys Branch, 1908. *Presented by the Department of the Interior, Ottawa.*

Canada, **Department of the Interior, Ottawa.**

Standard topographical map of Canada. Scale 1 : 500,000 or 1 inch to 7·9 stat. miles. Sheet 11, Montreal and Quebec. Ottawa : Department of the Interior, 1908. *Presented by the Department of the Interior, Ottawa.*

Canada. **Rand, McNally & Co.**

Western Canada, showing the Provinces of Alberta and Saskatchewan. Scale : 1 : 3,801,600 or 1 inch to 60 stat. miles.—British Columbia. Scale 1 : 2,407,680 or 1 inch to 38 stat. miles.—Ontario. Scale 1 : 740,480 or 1 inch to 18 stat. miles. Chicago and New York : Rand, McNally & Co., 1909.

Chile. **Oficina de Mensura de Tierras, Santiago.**

Atlas de la Republica de Chile. Scale 1 : 500,000 or 1 inch to 7·9 stat. miles. Sheets : Copiapo, La Serena, San Felipe. Santiago : Oficina de Mensura de Tierras, 1909. *Presented by the Oficina de Mensura de Tierras, Santiago.*

United States. **Rand, McNally & Co.**

Colorado. Scale 1 : 1,013,760 or 1 inch to 16 stat. miles. South Dakota. Scale 1 : 1,330,560 or 1 inch to 21 stat. miles. Texas. Scale 1 : 1,267,200 or 1 inch to 20 stat. miles. Utah. Scale 1 : 1,457,280 or 1 inch to 23 stat. miles. Virginia. Scale 1 : 887,040 or 1 inch to 14 stat. miles. Wyoming. Scale 1 : 1,520,640 or 1 inch to 24 stat. miles. Chicago and New York : Rand, McNally & Co., 1909. *Price* $0.25 *each.*

GENERAL.

German Colonies. **Sprigade and Moisel.**

Grosser Deutscher Kolonialatlas. Bearbeitet von Paul Sprigade und Max Moisel. Herausgegeben vom Reichs-Kolonialamt. Ergänzungs-Lieferung 1. Die deutschen Besitzungen in Stillen Ocean und Kiautschou. Berlin : Dietrich Reimer (Ernst Vohsen), 1909. *Price* 5*m. Presented by the Publisher.*

In the year 1893 an atlas of the German Colonies was published, by the authority of the German Government, on the scale of 1 : 3,000,000, by the geographical establishment of Justus Perthes, Gotha ; and immediately after this appeared, another official colonial atlas, on a larger scale (1 : 2,000,000), was published by Dietrich Reimer, in Berlin, and was finished in 1897. However, since that date such a large amount of cartographical material has become available that it has been considered necessary to issue supplementary maps of the more important colonies, upon which fuller detail can be shown, and which can be added to and corrected from time to time as necessity arises. The first of these supplementary parts is that here mentioned ; it contains the following maps : 25, Uebersichskarte der Deutschen Besitzungen in Stillen Ocean und von Kiautschou ; 26 and 27, Deutsch-Neuguinea ; 28, Marianen und Marshall-Inseln ; 29, Karolinen.

World. **Vidal-Lablache.**

Histoire et Geographie. Atlas général Vidal-Lablache. 420 Cartes et Cartons: Index Alphabétique de 46,000 noms. Paris: Armand Colin, 1909. *Price* 30 *fr. Presented by the Publisher*

The new edition of this atlas, which was referred to in the *Geographical Journal* for January last, is now complete. In addition to the 420 maps and plans, full explanatory and descriptive notes, together with a complete index, are given, which add to the value and general utility of the atlas. Although France and the French Colonies naturally occupy a considerable space in the atlas, yet other parts of the world are well represented.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during May, 1909. *Presented by the Hydrographer, Admiralty.*

New Charts.

No.	Inches.	
153 m	= 5·0	France:—Villefranche bay, port of Nice and St. Hospice bay. 2*s.*
321 m	= 0·5 / 1·0	Lake Superior:—Shesheeb entrance to Grand Portage bay including Thunder bay and isle Royale. Plan:—Port Arthur and Fort William. 3*s.*
3732 m	= 2·95	Malacca strait:—Penang harbour. 2*s.*
3721 m	= 0·35	Borneo:—Masa Tiga island to Pontianak. 3*s.*

New Plans and Plans added.

2313 m	= 5·7 / 1·45	Norway, sheet XI. Andö to Helgö:—New Plan:—Tromsö havn. Plan added:—Andenes havn. 3*s.*
2575 m	= 2·35 / 4·90	Celebes sea, eastern part, Plans added:—Port Tumamao, Port Bolai. 3*s.*
957 m	= 1·4	Ports in the Phillippine islands:—New Plan:—Palak harbour. 2*s.*
2995 m	= 0·75 / 0·75	New Guinea:—Suloga harbour. Plans added:—Gawa island. Alcester islands. 1*s.* 6*d.*

Charts Cancelled.

No.		Cancelled by	No.
153	France Villefranche road, port of Nice and St. Hospice bay.	New chart: Villefranche bay, port of Nice and St. Hospice bay	153
321	Lake Superior:—Grand Portage bay to Hawk islet, including isle Royale. Plan:—River Kaministiquia.	New chart. Shesheeb entrance to Grand Portage bay, including Thunder bay and isle Royale. Plan:—Port Arthur and Fort William . .	321

New Editions.

No. 3558, South America, east coast:—River Paraná from Paraná to Caalayti sand. 3648, Africa, west coast:—Junk river to Cestos bay. 1746, Borneo: Api point to Sarawak. 2577, Philippine islands:—Between St. Bernardino and Mindoro straits.

Atlantic, North. **U.S. Weather Bureau**

Meteorological chart of the North Atlantic Ocean, August, 1909. Washington: Department of Agriculture, U.S. Weather Bureau, 1909. *Presented by the U.S. Weather Bureau.*

Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly meteorological charts of the North Atlantic and Mediterranean, July, 1909. London: Meteorological Office, 1909. *Price* 6*d. each. Presented by the Meteorological Office.*

Indian Ocean and Red Sea. **Meteorological Office.**

Monthly meteorological charts of the Indian Ocean north of 15° S. lat. and Red Sea, July, 1909. London: Meteorological Office, 1909. *Price* 6*d. each. Presented by the Meteorological Office.*

Pacific, North. **U.S. Weather Bureau.**

Meteorological chart of the North Pacific Ocean, August, 1909. Washington: Department of Agriculture, U.S. Weather Bureau, 1909. *Presented by the U.S. Weather Bureau.*

Pacific, North. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, July, 1909. Washington: U.S. Hydrographic Office, 1909. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Bengal and Assam. **Faulkner.**

Thirteen photographs of Bengal and Assam, taken by P. Leo Faulkner, Esq. *Presented by P. Leo Faulkner, Esq.*

These interesting little photographs were taken by Mr. Faulkner during the time he was stationed at Shillong and Bhagalpur, as an officer of the Indian Police.

(1) Three wandering mendicants of Bhagalpur; (2) A bazaar scene at Bhagalpur; (3) A busy part of the Bhagalpur bazaar; (4) The ubiquitous but invaluable "tikka ghari"; (5 and 6) The Ward lake, Shillong; (7 and 8) Khasi girls who are taught in the R.C. Convent, Shillong; (9) The belfry of the R.C. Church, Shillong; (10) The Azalea Walk, Shillong; (11) The Crinoline falls, Shillong; (12) A Uriya, a Bengali Musulman, and a Gurkha; (13) A typical thatched bungalow in Shillong.

Brazil. **Mission Brésilienne.**

Ten photographs of Brazil, taken by the Mission Brésilienne. *Presented by the Serviço de Propaganda e Expansão Economica do Brazil, Paris.*

(1) The President's palace, Bello Horizonte (Minas Geraes); (2) The public garden, Bello Horizonte; (3) The police barracks, Bello Horizonte; (4) Troops marching, Bello Horizonte; (5) The station, S. João d'el Rey (Minas Geraes); (6) The station, Barbacena (Minas Geraes); (7) Cloth factory, Juiz de Fora (Minas Geraes); (8) Central station of the Caruaru-Pernambuco railway; (9) A road and river, Aracaju (Sergipe); (10) Ministry of Finance, Aracaju (Sergipe).

Kashmir. **Gillies.**

Photograph of a rock-carving some 9 miles east of Leh, Kashmir, taken by Captain F. G. Gillies, 23rd Cavalry, in May, 1907. *Presented by Captain F. G. Gillies.*

Nigeria. **Searight.**

Ten photographs of Northern Nigeria, taken by Major fforde Searight. *Presented by Major fforde Searight.*

A few supplementary photographs, completing the set noticed in the *Geographical Journal* for August last.

(1 and 2) Marabout storks at Kano; (3–5) Troops operating near Kano; (6) Officer's new mess, Kano; (7 and 8) Artillery in action; (9) Building the roof of a grass house.

Scotland. **Longstaff.**

Fourteen photographs of Scotland, taken by Captain F. V. Longstaff in 1905–1909. *Presented by Captain F. V. Longstaff.*

These are a continuation of the photographs previously presented, and which were noticed in the *Geographical Journal* for June last.

(1) View up the Spey from Craig Beg, Kingussie; (2) The frozen Alt Mor and the Gaick forest; (3) Kingussie from iron bridge; (4) House near golf course, Kingussie; (5) Western Cairn Gorms, Kingussie; (6) a fallen giant, Rothiemurchus forest, Cairn Gorm mountains; (7) River Druie, Rothiemurchus forest; (8) Abernethy forest; (9) View north-east from Cairn Toul, Cairn Gorm mountains; (10) Loch Morlich, Cairn Gorm mountains; (11) Larig Ghru from north, Cairn Gorm mountains; (12) The end of Loch Eunach, Cairn Gorm mountains; (13) Glen Geusachan from Cairn Toul; (14) Glen Dee from the Pools of Dee.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

CO-ORDINATES OF TRIGONOMETRICAL STATIONS.

Name.	Latitude.	Longitude E.	Height.
	° ′ ″	° ′ ″	feet.
CHAMIUMBU	S. 1 00 13·624	30 08 19·108	6,167·0
IHUNGA	S. 0 59 41·404	30 02 31·037	7,175·0
KASOMORA	S. 0 51 03·034	30 03 49·306	5,088·7
KASESE	S. 0 52 32·763	29 54 23·839	5,834·3
ITEMBI	S. 0 47 40·185	29 59 18·140	6,363·7
KARE REMA	S. 0 58 11·053	29 50 58·254	7,616·8
RUANKOBA	S. 0 44 54·611	29 51 46·679	5,392·8
NKABWE	S. 0 54 02·137	29 35 14·291	6,165·4
KAMORORA	S. 0 40 51·885	29 37 17·586	3,547·8
KABALI	S. 0 39 45·332	29 27 53·779	3,022·3
KITIMBO	S. 0 32 47·008	29 39 00·477	3,153·3
IZUMU	S. 0 38 46·226	30 02 36·049	5,814·5
KATI	S. 0 37 36·998	29 56 29·249	5,279·5
BUAMBARA	S. 0 36 01·559	29 47 57·206	3,717·9
KITAMPUNGU	S. 0 24 04·748	30 02 00·372	5,456·0
BUSHABWANYAMA ...	S. 0 18 28·935	29 52 38·073	3,354·2
KIBONA O.S.	S. 0 13 33·741	30 03 06·660	3,143·6
CHEKOBA	S. 0 15 41·266	30 04 09·890	4,648·9
NALUZIGUTI	S. 0 07 00·691	29 55 13·917	3,493·6
KITOMA	S. 0 04 58·270	30 10 10·386	3,090·8
CHAMATUM	S. 0 01 49·993	29 56 32·252	4,479·4
KAHOCHI	N. 0 03 52·817	29 59 25·096	5,087·8
KASAZU	N. 0 07 09·845	30 10 39·666	3,018·7
NKENDA	N. 0 14 48·270	30 05 58·433	5,532·4
KAVANDARA	N. 0 15 28·556	30 19 14·103	4,730·2
HARAGATWE	N. 0 01 50·630	30 19 28·962	4,369·2
KYATWA	N. 0 26 30·797	30 13 01·381	5,164·4
KASANGARI	N. 0 27 27·149	30 05 34·284	7,421·4
KARANGORA	N. 0 38 04·444	30 07 18·163	9,886·6
NJARA	N. 0 40 04·056	30 17 11·464	5,201·0
MSANDAMA	N. 0 44 50·929	30 10 03·255	7,995·7
KIDURU	N. 0 45 42·192	30 21 58·976	5,561·0
BEHANGA	N. 0 56 40·494	30 18 00·671	2,415·4
KIERU O.S.	N. 0 57 27·869	30 10 40·074	2,126·0
ISURA	N. 1 10 40·357	30 11 14·897	5,844·5
KALEVI	N. 0 58 19·330	29 54 00·212	5,057·8
MIKORA	N. 1 18 01·614	30 03 38·219	6,306·0
LAGORA	N. 1 25 56·686	30 18 22·447	5,357·2
LIANGU	N. 1 35 14·234	30 10 06·794	4,343·0
NYAMAVI	N. 1 20 07·387	30 23 51·276	2,036·8
KOROVI	N. 1 39 40·427	30 35 56·158	7,117·8
PIKOTI	N. 1 37 23·431	30 24 20·114	6,495·3
ANI	N. 1 49 52·444	30 47 19·950	7,165·8
AJO	N. 1 55 37·697	30 47 58·072	7,945·2
NARDAMBO	S. 0 11 37·935	30 05 59·908	3,493·0
KASUNI	[illegible]	[illegible]	[illegible]

CENTRAL EQUATORIAL AFRICA.

Survey of
THE UGANDA-CONGO BOUNDARY
on the
Western Frontier of

THE UGANDA PROTECTORATE

by
THE BRITISH COMMISSION
under the command of
LIEUT.-COL. R. G. T. BRIGHT, C.M.G.
1907-08.

Reference

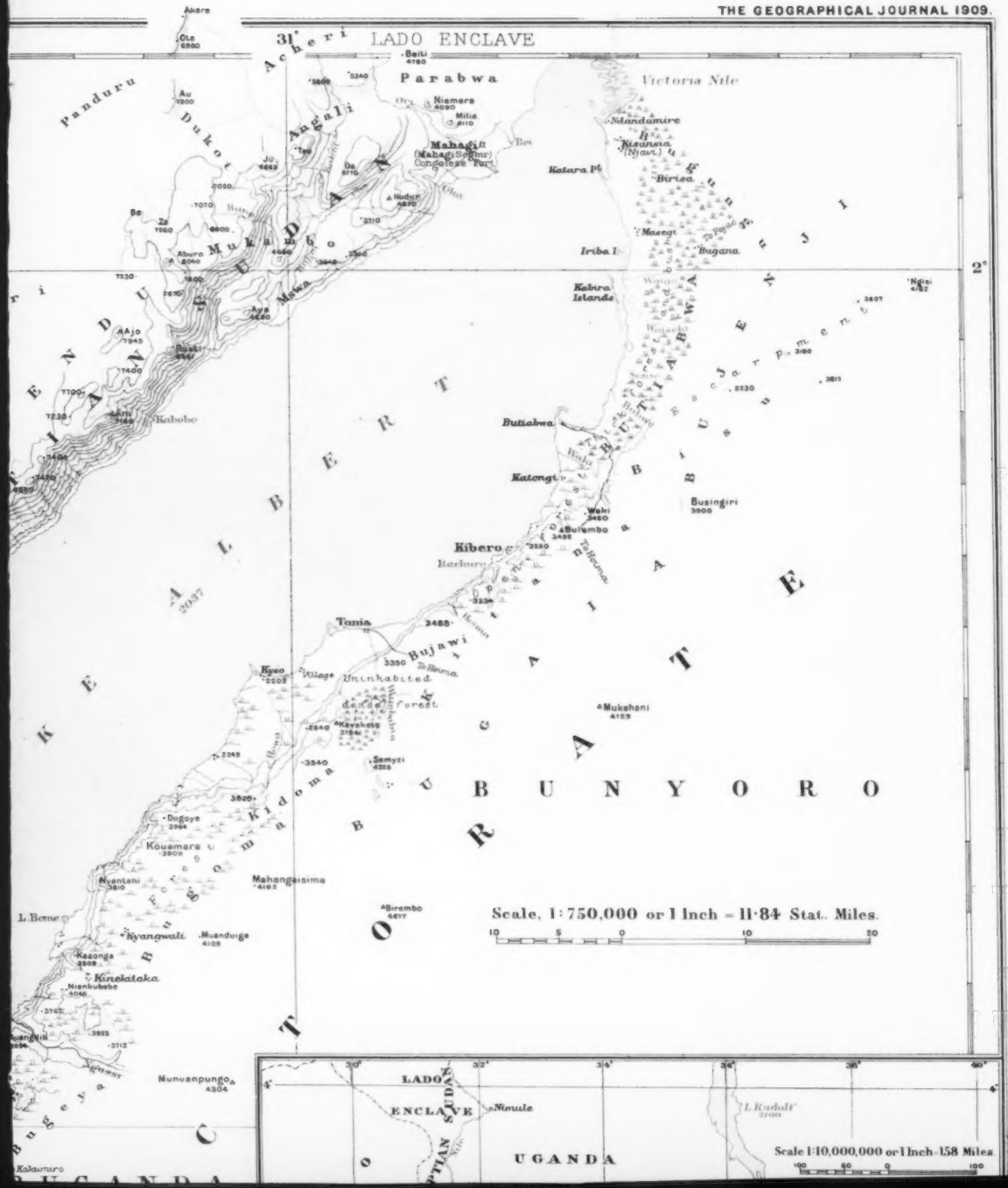
Rivers and streams, perennial, generally running or in pools
" " " sometimes dry
Main caravan routes
Scattered huts
Trigonometrical points
Contours at intervals of 500 feet (approximate)
Heights in feet.

THE MUFUMBIRO VOLCANOES.

View from Nkalwe.

30°
2°
1°
Mujeri
Kasuru
Kahanama
Bukenge
Kafenyi
Kasuru
Waka
Alo
Nyoza
Mikoro
Kanyangabi
Mgoga
Birisma
Congolese Sta.
Nyambabo
Kiagoda
Mbugu
Kisanja
Kalavi
Kitenkeri
Kilyama
Irumu
Congolese Sta.
Kifuku
Maryaribu
Bema
Dense forest
Dense forest
Bukima
Lake Albert
Lake Edward
South Bay
Ruangiri
Ndigori
Kitumba
Muruha
Nkuruhu
Bwanga
Bungeye
Behanga
Ruwenzori
Congo
Uganda
Ituri
Toro
Belgian Congo
Nyamwamba
Nyamuamba
Lamia
Lubiliha
Lora
Nyamabalo
Atoto
Nyamwamba
Nyamuamba
Kafenyi

THE UGANDA-CONGO BOUNDARY.
Bright.



PIKOTI	N. 1 37 23·431	30 24 20·114	6,495·3
ANI	N. 1 49 52·444	30 47 19·950	7,165·8
AJO	N. 1 55 37·697	30 47 58·072	7,945·2
NAROAMBO	S. 0 11 37·935	30 05 59·908	3,493·0
KASUNI	S. 0 51 47·525	29 41 04·868	5,391·1
MBIREMBU	S. 0 03 11·221	29 40 29·194	4,279·6
KAREMIA	N. 0 05 39·100	29 42 38·983	5,646·2
MIREGO	N. 0 06 33·329	29 38 50·611	3,207·8
HANGI	N. 0 09 54·777	29 43 29·586	5,854·5
LIBONA	N. 0 22 13·303	29 36 21·700	3,812·1
VYATUNGU	N. 0 27 02·549	29 46 21·114	5,874·7
PORUO	N. 0 52 58·387	29 43 09·098	4,406·7
BOME	N. 0 34 56·779	29 52 05·821	4,248·7

LAKE ALBERT	2037
LAKE EDWARD	3000
LAKE GEORGE	3000

POSITIONS AND HEIGHTS OF THE RUWENZORI AND MUFUMBIRO PEAKS.

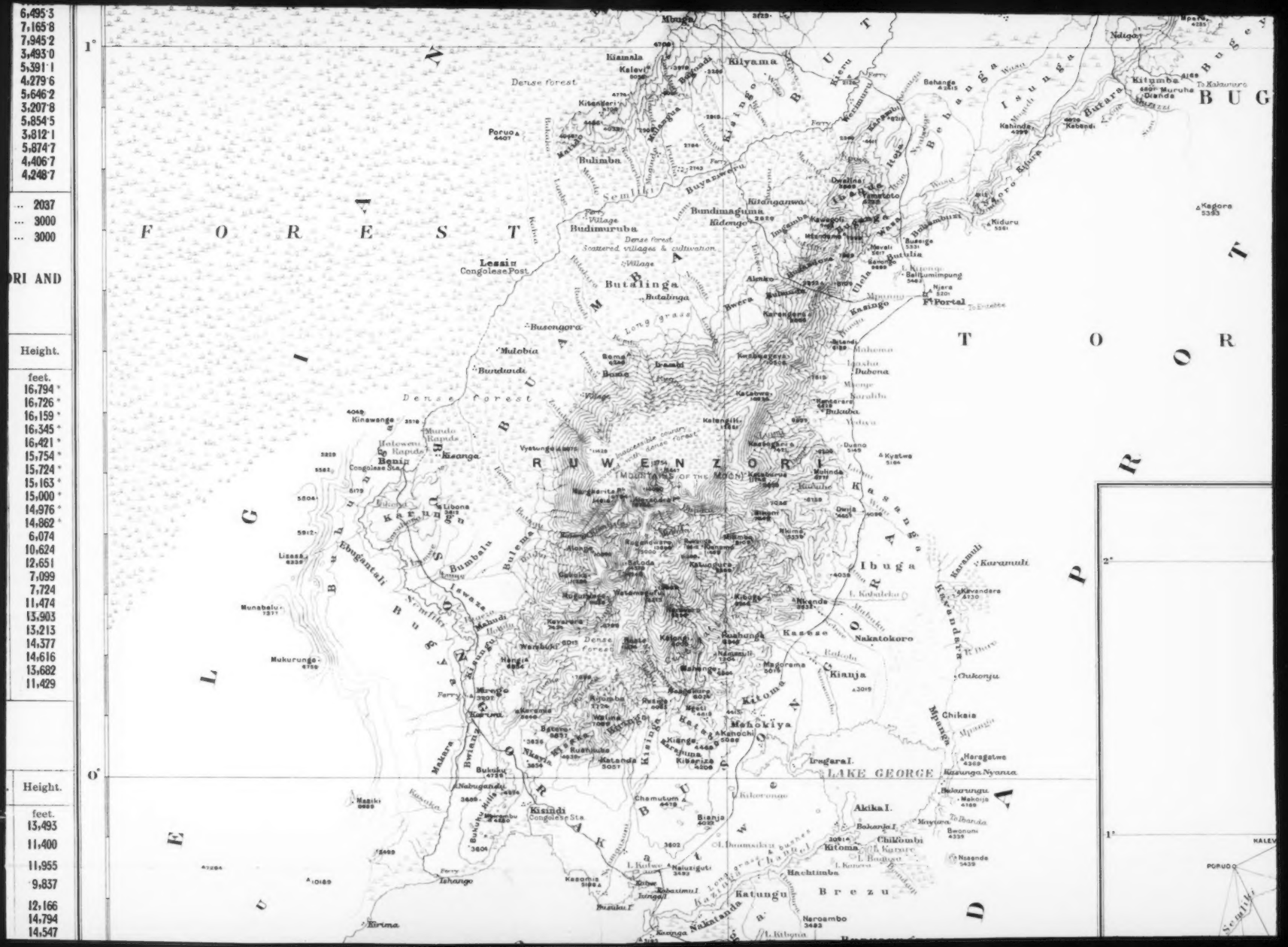
RUWENZORI.

Name.	Latitude.	Longitude E.	Height.
			feet.
MARGHERITA	N. 0 23 07	29 52 16	16,794 *
ALEXANDRA	N. 0 23 02	29 52 13	16,726 *
MOEBIUS	N. 0 22 38	29 52 17	16,159 *
ELENA	N. 0 22 26	29 52 29	16,345 *
SAVOIA	N. 0 22 24	29 52 38	16,421 *
UMBERTO	N. 0 25 40	29 53 53	15,754 *
KRAEPLIN	N. 0 26 08	29 53 55	15,724 *
WEISMANN	N. 0 19 45	29 53 08	15,163 *
R_2	N. 0 19 05	29 52 44	15,000 *
R_4	N. 0 18 36	29 52 15	14,976 *
R_{17}	N. 0 18 20	29 52 14	14,862 *
R_6	N. 0 06 44	29 58 56	6,074
R_{14}	N. 0 31 55	30 04 12	10,624
R_{15}	N. 0 29 10	30 01 22	12,651
R_1	N. 0 04 28	29 48 40	7,099
R_{10}	N. 0 06 14	29 48 26	7,724
R_5	N. 0 11 09	29 51 23	11,474
R_3	N. 0 16 05	29 52 19	13,903
R_{16}	N. 0 15 04	29 54 57	13,213
R_9	N. 0 18 11	29 52 57	14,377
R_{11}	N. 0 23 00	29 50 10	14,616
R_{19}	N. 0 15 41	29 54 20	13,682
R_{20}	N. 0 26 52	29 48 46	11,429

* Snow-peaks.

MUFUMBIRO.

Name.	Latitude.	Longitude E.	Height.
			feet.
MUHAVURA	S. 1 22 58	29 40 34	13,493
MGAHINGA	S. 1 23 3 / 1 23 12	29 38 39 / 29 38 32	11,400
SABYINO	S. 1 23 21	29 35 20	11,955
NAMLAGIRA	S. 1 23 21 / 1 23 23	29 33 39 / 29 33 21	9,837
VISSOKE	S. 1 27 26	29 29 1	12,166
KARISIMBI	S. 1 30 22	29 26 55	14,794


6,495·3
7,165·8
7,945·2
3,493·0
5,391·1
4,279·6
5,646·2
3,207·8
5,854·5
3,812·1
5,874·7
4,406·7
4,248·7
.. 2037
... 3000
... 3000
RI AND
Height.
feet.
16,794 *
16,726 *
16,159 *
16,345 *
16,421 *
15,754 *
15,724 *
15,163 *
15,000 *
14,976 *
14,862 *
6,074
10,624
12,651
7,099
7,724
11,474
13,903
13,213
14,377
14,616
13,682
11,429
Height.
feet.
13,493
11,400
11,955
9,837
12,166
14,794
14,547
1°
0°
2°
1°
F O R E S T
Dense forest
Scattered villages & cultivation
Long grass
Lessu
Congolese Post
Butalinga
Busongora
Mutobia
Burunduli
Kinawonga
Kisanga
Congolese Sta.
Libona
Lisasa
Munabelu
Mukurungo
Bukuku
Nabugandi
Kisindi
Congolese Sta.
Tshango
Kirima
Bulimba
Porua
Bundimaguma
Kidengo
Village
Butalinga
Bama
Izambi
Kalengeli-Hill
Vyatunga
Kasenyi
Kasebura
Kasebura
Kasebura

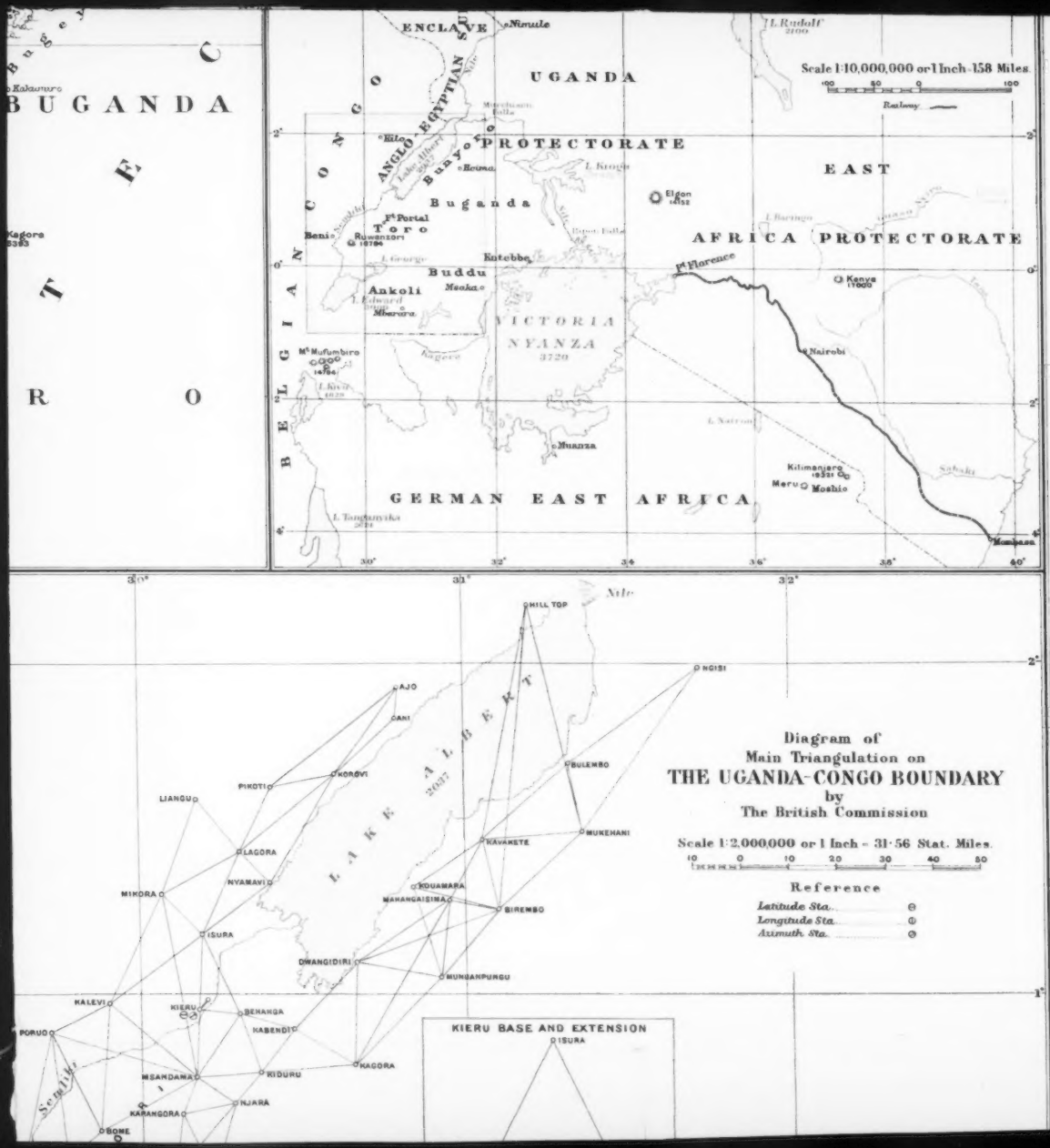


Diagram of
Main Triangulation on
THE UGANDA-CONGO BOUNDARY
by
The British Commission

Scale 1:2,000,000 or 1 Inch = 31·56 Stat. Miles.

10 0 10 20 30 40 50

Reference

Latitude Sta. ⊖
Longitude Sta. ⊕
Azimuth Sta. ⊙

SABYINO		S.	1 25 21	29 33 20	11,555
NAMLAGIRA		S.	1 23 21 1 23 23	29 33 39 29 33 21	9,837
VISSOKE		S.	1 27 26	29 29 1	12,166
KARISIMBI		S.	1 30 22	29 26 55	14,794
MIKENO		S.	1 27 47	29 25 7	14,547
VIRAGONGO		S.	1 31 26 1 31 7	29 15 11 29 14 36	11,360

NOTE.—Where two positions are given they are of two points roughly east and west on crater edge.

EASTERN SHORE LAKE ALBERT.
(RAPID TRIANGULATION.)

Name.	Latitude.	Longitude E.	Height.
			feet.
KAGORA	N. 0 46 59·5	30 39 9·5	5,393
DWANGIDIRI	N. 1 5 48	30 39 37	3,944
MUNUANPUNGO ...	N. 1 3 6	30 55 31	4,304
BIREMBO	N. 1 15 15	31 6 10·5	4,677
KOUAMARA	N. 1 19 27·5	30 50 16	3,909
KAVAKETE	N. 1 28 12	31 3 9	3,794
MUKEHANI	N. 1 29 24	31 21 47	4,729
BULEMBO	N. 1 41 41	31 19 6·5	3,492
MAHANGAISIMA ...	N. 1 17 6	30 56 59	4,162
KABENDI	N. 0 53 43·5	30 28 7	4,920

	9,837
	12,166
	14,794
	14,547
	11,360

are of two

	Height.
	feet.
	5,393
	3,944
	4,304
	4,677
	3,909
	3,794
	4,729
	3,492
	4,162
	4,920

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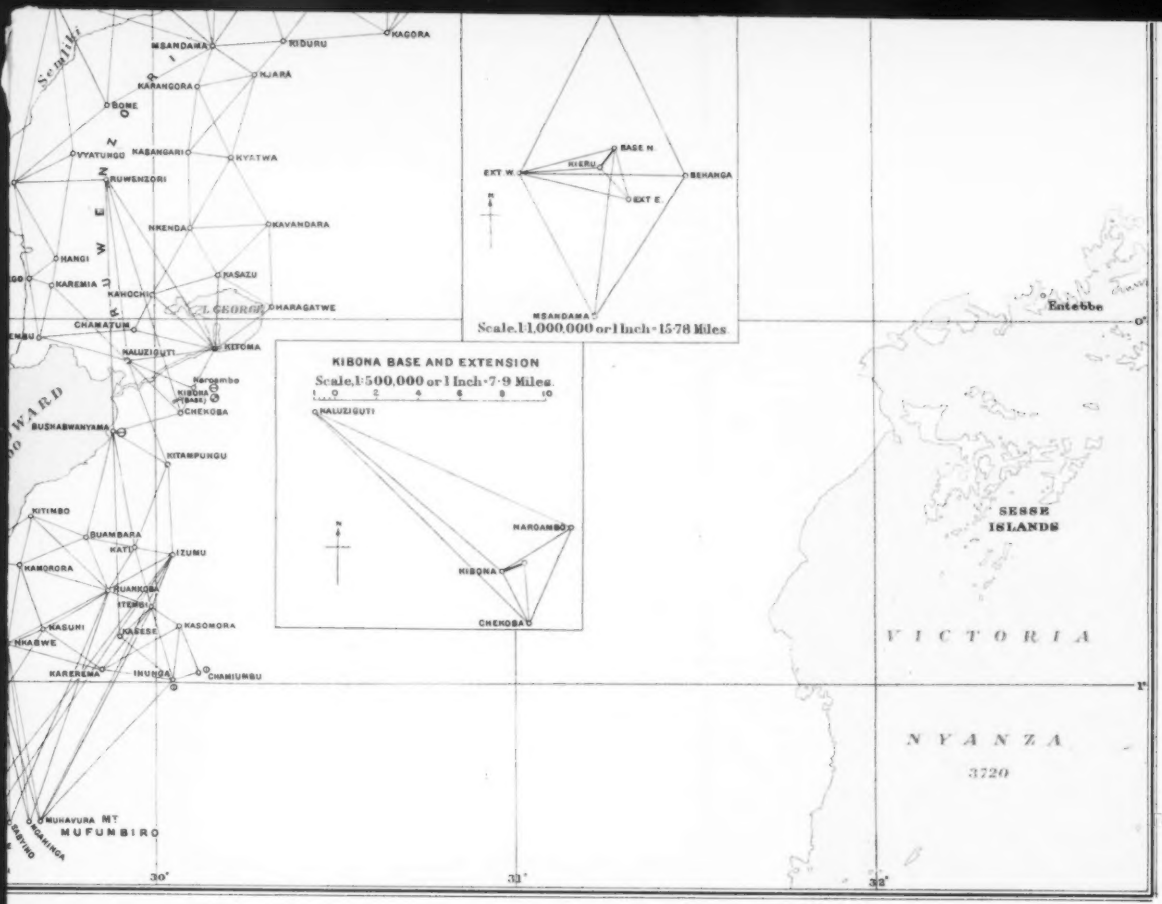
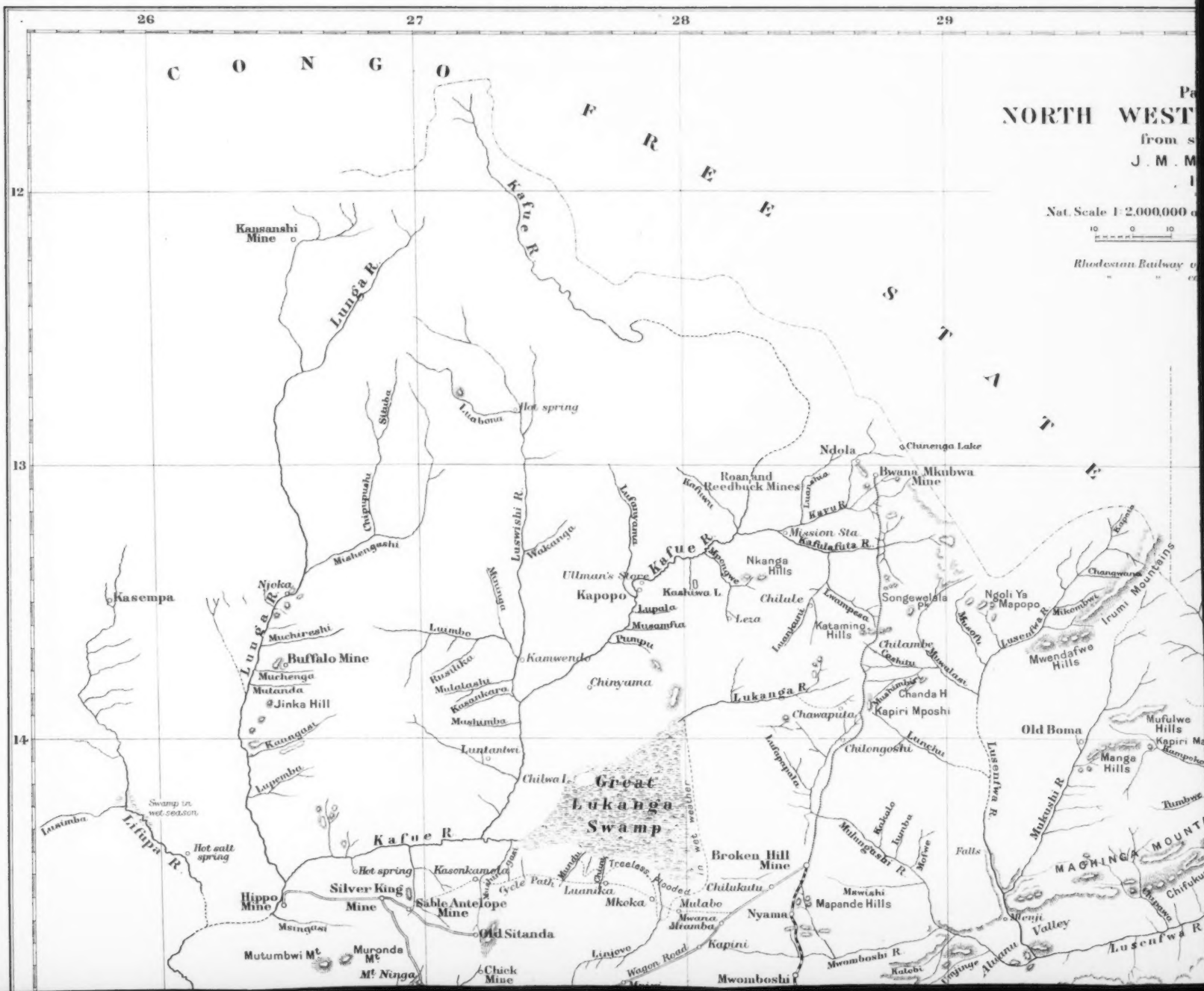
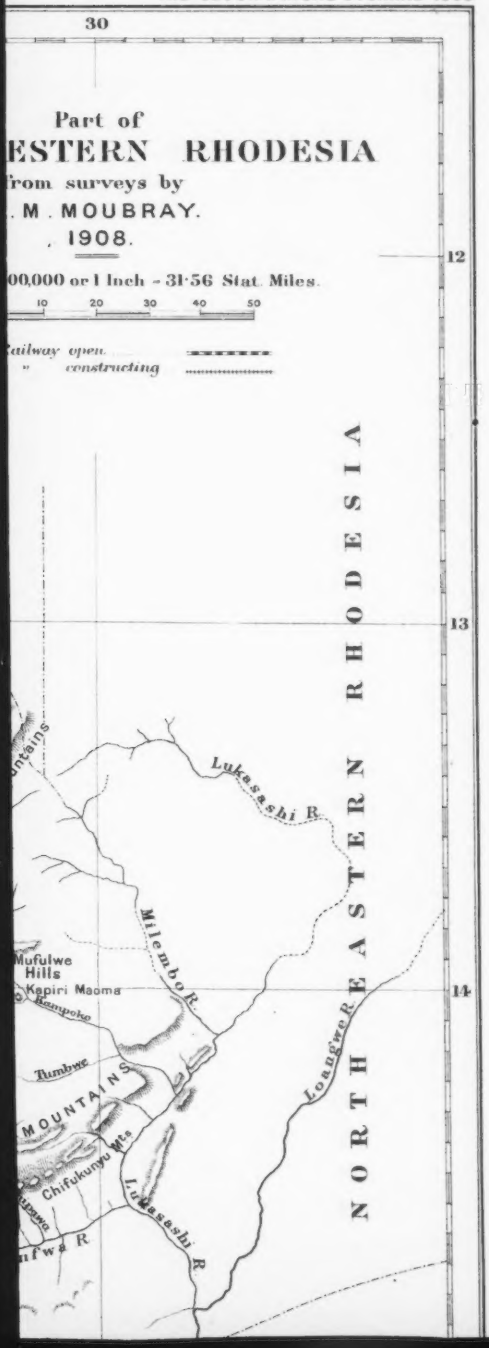
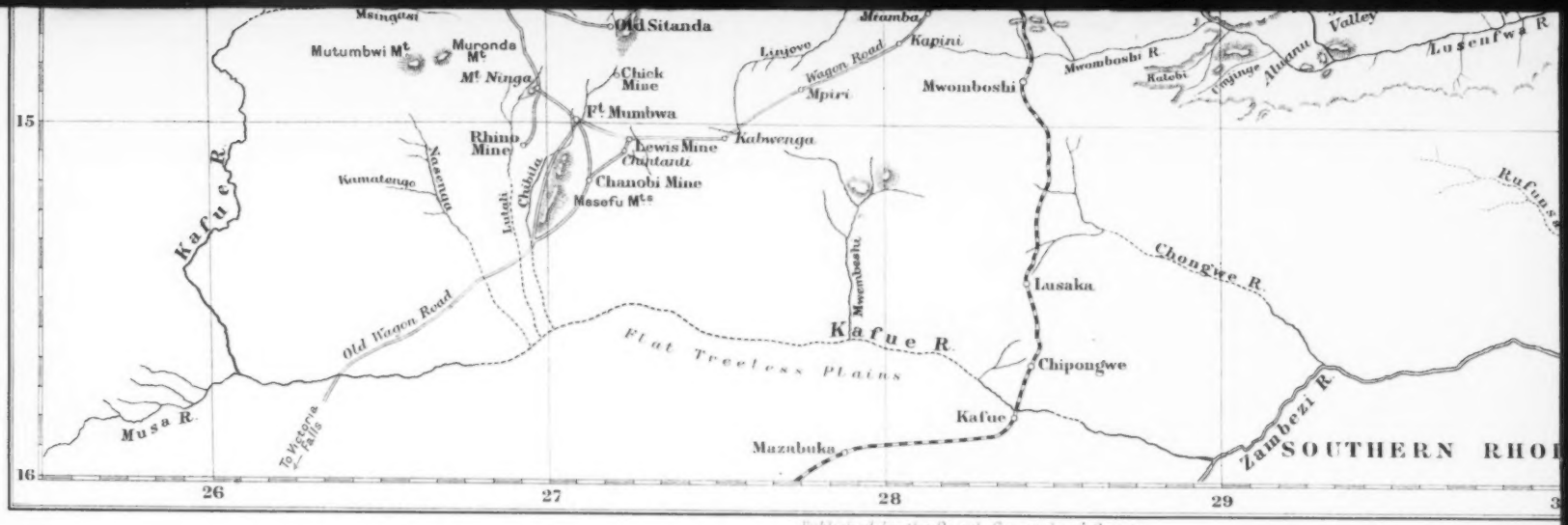

MSANDAMA
KIDURU
KAGORA
KARANGORA
KJARA
BOME
VYATUNGO
KASANGARI
KYATWA
RUWENZORI
NKENDA
KAVANDARA
HANGI
KAREMIA
KASAZU
KAHOCHO
HARAGATWE
CHAMATUM
KITOMA
NALUZIGUTI
Naroombo
KIBONA (BASE)
CHEKOBA
BUSHABWANYAMA
KITAMPUNGU
KITIMBO
BUAMBARA
KATI
IZUMU
KAMORORA
BUANKOBA
ITEMBE
NASUNI
KASESE
KASOMORA
NHABWE
KARERAMA
INUNGA
CHAMIUMBU
MUHAVURA MT
MUFUMBIRO
KARUNGA
KIGANINGA
BASE N
EXT W.
KIERU
BEHANGA
EXT E.
MSANDAMA
Scale, 1:1,000,000 or 1 Inch = 15·78 Miles.
KIBONA BASE AND EXTENSION
Scale, 1:500,000 or 1 Inch = 7·9 Miles.
1 0 2 4 6 8 10
NALUZIGUTI
NAROMBO
KIBONA
CHEKOBA
Entebbe
SESSE ISLANDS
VICTORIA
NYANZA
3720
30°
31°
32°
1°
0°


26
27
28
29
12
13
14
C O N G O
F R E E
S T A T E
Kafue R.
Lunga R.
Kansanshi Mine
Kasempa
Njoka R.
Buffalo Mine
Jinka Hill
Kanagasi
Lupemba
Lusaimba
Lifupa R.
Swamp in wet season
Hot salt spring
Hot spring
Kasonkamela
Hippo Mine
Silver King Mine
Sable Antelope Mine
Old Sitanda
Mutumbwi Mt.
Muronda Mt.
Mt. Ninga
Chick Mine
Great Lukanga Swamp
Treeless Flooded Area
Cycle Path
Broken Hill Mine
Chilukutu
Mkoka
Mulabo
Nyama
Kapini
Linjovo
Wagon Road
Mwomboshi R.
Mwomboshi
Ullman's Store
Kapopo
Kashiwa L.
Lukanga R.
Chawaputa
Chinyama
Chilwa L.
Chilule
Leza
Nkanga Hills
Mission Sta.
Kafulafuta R.
Karu R.
Roan and Reedbuck Mines
Bwana Mkubwa Mine
Ndola
Chunenga Lake
Songewelala Pk.
Katamino Hills
Chanda H.
Kapiri Mposhi
Ngoli Ya Mapopo
Irumi Mountains
Mwendafwe Hills
Old Boma
Mufulwe Hills
Manga Hills
Chalongoshi
Lunchu
Mukushi R.
Lusenfwa R.
Mapande Hills
Mwichi
Falls
Mulungushi R.
Kabwe
Iumba
Morwe
Kalabi
Abijanu
Valley
MACHINGA MOUNTAINS
Chifukuwa
Chimawa
Tumbwe
Kapiri Ma
Kampeche
Luchele
Luanika
Mwana Mramba
Lusenfwa R.
Hot spring
Luabona
Sitaba
Chipushi
Mishengashi
Muchureshi
Muchenga
Mutanda
Lumbe
Rusuka
Mulalashi
Kasankara
Mushumba
Luntantwi
Kanwendo
Mununga
Luswishi R.
Wakanga
Lufenyama
Kafiwa
Lusenfwa
Mwange
Lusenga
Lwampesa
Lupula
Musamfia
Pumpu
Mwaimbwa
Ceshiu
Mwaiasi
Mwaofu
Mukombwa
Kapopo
Irumi Mountains

NORTH WESTERN RHODESIA.
Moubray.





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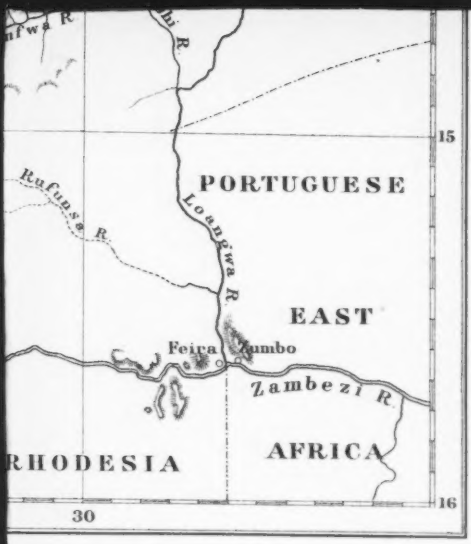
R
hi R
15
PORTUGUESE
Rufunsa R
Loangwa R
EAST
Feira
Zambo
Zambezi R
RHODESIA
AFRICA
16
30